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How Long Can The Lead-Zinc Quotas Last?

THE year now ending has witnessed a remarkable transformation in the market outlook for zinc and also the partial recovery of lead. In 1958 world output of zinc, excluding the U.S., amounted to 2,330,000 l. tons, being some 70,000 l. tons lower than in the previous year. Consumption for the second year running reached about 1,780,000 tons. The " rest of the world " surplus in 1958 was thus approximately 550,000 tons, virtually all of which went to the United States. In the latter country, however, consumption of slab zinc, which had dropped from 1,000,000 tons in 1955 to 825,000 tons in 1957, fell further to 740,000 tons in 1958.

The supply-demand picture for lead, broadly speaking, followed much the same pattern as for zinc, one of the consequences in each case being a steep fall in U.S. mine production. This led to the imposition of the controversial lead-zinc quotas, which—from the standpoint of producers in other countries — had the effect of making a bad situation even worse.

In May this year, after two international conferences had failed to produce positive action, a meeting of the 21-nation Lead and Zinc Committee of the U.N. Economic and Social Council led to agreement on voluntary cuts in output and sales. These were designed to reduce the excess supply of available lead metal (which had been estimated at 150,000 tonnes for 1959) to an annual rate of 59,000 tonnes in the second half of 1959. For zinc metal the decrease, similarly calculated, was from 120,000 to 16,000 tonnes.

Since the introduction of these corrective measures the recovery of zinc, aided by an unexpectedly rapid recovery in world demand, has been quite spectacular. Demand, in fact, is now tending to outstrip production and there is currently a shortage of prompt zinc. From £74 at the end of April, 1959, the L.M.E. cash quotation has risen to over £95, with metal for three months' delivery in the region of £90. For once in a way the Board of Trade has been able to offload stockpiled metal at profitable prices without disrupting the market and without much adverse criticism from the trade.

In these greatly changed circumstances, and with the economic barometer pointing to the probability of further gains in consumption during the coming year, there is growing support for the view that no useful purpose would be served by extending the voluntary cutbacks in world zinc supplies. It is to be expected, therefore, that at the next meeting of U.N.'s Zinc and Lead Committee, scheduled to start on January 25, serious consideration will be given to the advisability of rescinding the existing cutbacks. Indeed, it would hardly be surprising if some producers decided to step up output without waiting for the U.N. Committee to meet, on the ground that with future demand firmly assured it would be preferable to produce more zinc even at a lower price.

Unfortunately the situation is a good deal more complex than on first thoughts it might appear. In the first place the question of zinc supplies can scarcely be considered without reference to lead. The price of lead, though now exceeded by that of zinc, has also

risen substantially since the voluntary cutbacks were introduced. Statistically, however, lead remains in the weakest position of the major non-ferrous metals, world stocks (at the end of August) being still in excess of 300,000 tons. Despite a marked strengthening of demand in recent weeks, it seems more than doubtful whether lead is yet capable of standing on its own feet without continued assistance in one form or another. In view of the fact that, in so many cases, lead and zinc are products of the same mining operation, it may be no easy matter for the U.N. Committee to secure international agreement for voluntary cutbacks confined to only one of the two metals, though the difficulties are perhaps not insuperable.

Another consideration which cannot be overlooked is the possible impact of the Committee's decisions on U.S. import policy.

Economically, as well as politically, it is hard to see any justification for continuing to restrict the entry of foreign zinc into the United States. The U.S. price of zinc is now 1.50 c. higher than before the supply cutbacks were effected ; the statistical position of the metal has shown a marked improvement ; and, finally, domestic mines that early this year were operating on a four-day week have resumed full-time operations while, in addition, other mines are being brought into production. Obviously the short-term supply position will depend very largely on whether agreement is reached in the steel industry without further loss of production. However, it is possible that there may be a considerable squeeze in zinc supplies after the start of the new year, when it is expected that U.S. consumers will have worked off the large tonnages purchased during the autumn.

Within the U.S. itself the zinc industry is divided as to what the Government's policy should be with regard to the restriction of imports. Members of the industry engaged solely or primarily in domestic mining favour sharp restrictions on imports of both ore and metal. Many would like refined metal imports to be still further restricted, as well as a tighter curb on imports of fabricated products. On the other hand, firms engaged chiefly in custom smelting, which have to rely heavily upon importers, advocate the removal or easing of the present restrictions on ore imports.

Six U.S. companies, representing about half the domestic lead-zinc smelting and refining capacity, recently petitioned the U.S. Tariff Commission urging that the quotas be rescinded promptly and substituted by " reasonable " increases in import duties. These companies include American Smelting and Refining and American Zinc. The petition maintains that quotas are arbitrary and discriminatory in their impact on domestic smelters and refineries. By confronting domestic fabricators with uncertainty as to the continued availability of adequate supplies, they " impede consumption and encourage the use of substitute materials."

It is evident, therefore, that in considering how far the present rate of voluntary cutbacks could safely be relaxed, the U.N. Committee must guard against the possible combination of increased world supplies with a switch in U.S. import restrictions from quotas to higher tariffs. This situation could lead to a very serious downswing in sterling prices, particularly in the case of lead. For this reason it might be considered expedient, for the time being, to retain some restrictions on the sale of both metals, though possibly in modified form.

There are indications, however, that the controversial U.S. import quotas on lead and zinc may be accorded increasing attention at an even higher level than the 21-nation U.N. Lead and Zinc Committee. At Gatt's recent meeting in Tokyo, they came under heavy fire from both Australia and Canada, who warned the U.S. that, unless they were lifted, the two countries would consider invoking Article 19 of the agreement entitling members to adopt some form of retaliation by the withdrawal of trade concessions to the United States. It is certainly difficult to see how Washington can reconcile its own plea for the ending of discrimination against U.S. exports with a restrictive policy on goods entering its own border, whether this takes the form of import quotas or the imposition of higher tariff duties. This is truly a case of wanting to have your cake and eat it too—which, as usual promises to lead to an untenable position. Sooner, rather than later, Washington may have to decide whether it is worth jeopardizing the interests of U.S. exporters — and the U.S. dollar—for the sake of a single industry—and only a section of that industry to boot.

WORLD MINERAL PRODUCTION IN 1958

World production of many mineral commodities established new records in 1958 despite the business recession which adversely affected output in some countries, according to the Bureau of Mines, United States Department of the Interior. The Bureau's annual survey reveals new peaks for 12 of the 63 mineral items for which production data were compiled from 110 countries.

Among the metals only aluminium and its ore, bauxite, established new peaks. Production of iron ore declined 6 per cent and steel ingots and castings 7 per cent from previous records attained in 1957. Mine outputs of copper, lead, and zinc were approximately 4 per cent below former records also achieved in 1957. Drastic curtailment under the International Tin Agreement resulted in a 24 per cent decline in tin output from its 1957 peak. Gold and silver scored minor increases but in 1958 performances were 5 and 16 per cent, respectively, below the 1940 all-time records.

World production of coal and crude petroleum in 1958 reached new heights for the 10th consecutive year. This persistent rise in demand for fuels reflects the growing energy requirements of mankind which in turn connote progress in the advancement of living standards. Since 1949 output of coal increased 47 per cent while that of petroleum rose 94 per cent. The relatively greater expansion in petroleum is evidence of the fact that the liquid fuels are supplying a steadily increasing share of the world's energy market.

Eight non-metallic minerals also reached new production levels in 1958. The group included cement, diamonds (both gem and industrial), diatomite, gypsum, magnesite, phosphate rock, potash, and salt. World-wide construction activity, particularly road building, was responsible for the increased demand for cement and other building materials. Phosphate rock and potash peaks reflected the growing use of fertilizers needed to provide food and fibre supplies for a rapidly expanding world population.

The United States continues to lead the world in mineral output by a wide margin. It ranked first in production of 29 of the 63 commodities included in the Bureau of Mines study. The U.S.S.R. led in 8, while Canada led in 3. Sixteen other nations ranked first in production of 1 or 2 mineral items.

A significant feature of 1958 world mineral production was the U.S.S.R.'s displacement of the United States as the premier coal producer, a position the United States had held continuously since 1899. The United States, however, produced three times as much crude petroleum as the U.S.S.R. and over twice as much total energy. Iron ore production in the United States declined as a result of the business recession; that of the U.S.S.R. advanced to new peaks. Consequently, temporarily at least, the U.S.S.R. replaced the United States as the largest iron ore producer. The Soviet Union contributed 20.3 per cent of the world's steel compared with 28.6 per cent produced in the United States. Australia displaced the United States as the leading mine producer of lead and

Canada similarly became the leading mine producer of zinc in 1958.

Growing industrial strength of the communist world in relation to that of the United States and the free world is revealed in the gains made in mineral production in recent years. Between 1953 and 1958 the U.S.S.R. share of the world's steel output increased from 16.2 to 20.3 per cent and that of the entire communist world from 22.3 to 29.6 per cent. Free world proportions declined from 77.7 to 70.4 per cent; United States share declined from 43.1 to 28.6 per cent. The communists now produce half of the world's coal compared to 38.1 per cent in 1953. They produced 31.6 per cent of the iron ore in 1958 against 21.1 per cent 6 years earlier. The communist world also has scored gains in many other commodities including petroleum and the major nonferrous metals.

Appraisal of mineral production in the U.S.S.R. is uncertain because of the lack of official data from that source. The few mineral statistics released by the Soviet Government probably are subject to discounts owing to the differences in Soviet statistical procedures. The Bureau of Mines believes that the accuracy of official U.S.S.R. statistics and its own estimate of Soviet production varies with individual commodities. The margin of error in the figures given in this report probably ranges between 10 per cent above and 10 per cent below actual quantities. However, over a period of years the data are believed to reflect accurately basic trends in the U.S.S.R. mineral economy.

The situation in Communist China is difficult to assess at this time. Original claims by the regime in control as to phenomenal gains in the 1958 output of a few major mineral products recently have been revised downward in varying degrees. In particular, some statistical errors in previous reports of production of iron and steel products of acceptable grade were acknowledged. As a result of these developments the Bureau of Mines has revised substantially its former published estimates of pig iron and steel production. Data on coal production previously published still appear to be acceptable as representing the order of magnitude of coal output in 1958. Available data, apparently of a reliable nature, indicate that substantial progress is being made in the development of China's vast coal and iron ore resources.

UNDER-SEA MINERALS AND MINING RIGHTS

A report on "The Mining and Processing of Deep-sea Manganese Nodules," by Mr. John L. Mero, graduate research engineer of the University of California, was referred to in our issue of May 1, 1959, p. 463. In a paper on deep-sea mining presented recently at a Colorado Mining Association's conference at Denver, Mr. Mero gave further information on this subject, stating that approximately 14,200,000 square miles of ocean floor contained economically mineable manganese deposits totalling some 200,000,000,000 tons of nodules averaging 0.50 per cent each of nickel, copper and cobalt. This was enough to supply the world for hundreds of years.

Mr. Mero also said that the manganese dioxide occurred in the form of nodules, grains, coatings on rocks and impregnations in porous materials and that mining could be done either by suction dredge or the deep-sea drag bucket dredge. A remote-controlled suction dredge could deliver nodules through a 15-in. pipeline at a rate of 5,000 tons a day. Such a dredge would cost about $2,000,000 and mining costs would be about $3 a ton at 5,000 ft. and 15c. a ton extra for each additional 1,000 ft. of depth. Studies indicated that mining costs for a drag dredge would be about $5 per ton of recovered nodules at a depth of 1,000 ft. and $15 per ton at 5,000 ft. One of the huge nodule deposits was in the Blake Plateau, discovered about 200 miles east of the United States, by the Dawnwind Expedition in 1958.

Such vast quantities of under-sea minerals give rise to considerations of mineral claims and mineral rights for sea-bed deposits. At present it appears that it is a question of "first come with the best mining equipment, first claim" and that efficiency of production rather than location establishes sovereignty. How long such easy-going international sea laws will hold good remains to be seen however.

In addition to the rich sea-bed mineral deposits, the sea-water itself contains traces of metals which could be extracted by new chemical-flotation processes, though it is too early yet to evaluate the economic importance of these.

THE NEW COMMONWEALTH INSTITUTE

The present Commonwealth Institute building in South Kensington, when it was built between 1887 and 1893, was greatly embellished by many splendid and spontaneous gifts from all over the Empire. It appears that this admirable precedent will be followed with the new building to help to make it a show-place of the Commonwealth.

When the architects' designs for the new building were made public last June, mention was made that the copper to cover the roof would be the gift of the Northern Rhodesia Chamber of Mines. The amount involved is considerable: no less than 25 tons, valued at over £5,000.

The following are among other gestures of a similar kind which have since been made:

The copper from Rhodesia will be converted, free of cost, into 49,000 square feet of sheet copper by The Enfield Rolling Mills Ltd., Enfield, Middlesex.

The entire requirement of aluminium (up to 20 tons) has been promised by Aluminium Ltd. of Canada. The gift will be made through the Group's International Sales Organisation in the United Kingdom, Alcan (U.K.) Ltd. The bauxite from which the metal will be extracted in Canada will originate from British Guiana or Jamaica. The value of the ingot metal is nearly £4,000.

The vermiculite required for insulation, principally in the roof, will be presented by the Transvaal Ore Company, South Africa through Mandoval Ltd. of London. The quantity will be some 40-50 tons, worth roughly £1,500.

COAL MINING DOWN UNDER

Despite the rising economy in Australia it appears as though coal mining is in for a thin time. In the Australian Joint Coal Board's annual report it is indicated that the number of mines facing closure is increasing and it is forecast that several collieries will cease production in the next ten years. These, however, are high-cost collieries and on the brighter side it is reported that demand for coal is rising—particularly regarding exports.

The New South Wales collieries are destined to remain the major source of energy in Australia and will have an assured market in the rapidly expanding steel industry. These collieries have been intensively mechanized over the past ten years and production costs have been slashed. Ninety per cent mechanization has raised annual output almost to 16,000,000 tons—an increase of 3,000,000 tons with 7,000 fewer miners.

Completion of World's Largest Drill

CONSTRUCTED by methods and equipment designed by engineers of the Staatsmijnen, the two new Beatrix shafts will eventually serve what will be the fifth state-owned colliery in Holland, which is intended to exploit the Vlodrop field east of Roermond near the German border. By the acquisition of the adjoining German concessions, the available coal resources, which consist of semi-anthracite, bituminous and semi-bituminous coal, have been considerably enlarged and an eventual annual output of 1,800,000 tons is considered possible. By that time, the mine would have a labour staff of 6,000 to 7,000 underground and surface workers. Because of the present position in the coal-mining industry, however, it has been proposed that further development of the mine be postponed for the time being and this is now being considered by the Minister of Economic Affairs in Holland.

Both of the recently completed shafts at the Beatrix Mine have an effective diameter of 5.6 m. and a depth to the first coal seam of about 500 m.

Advantage of Drilling Process

Whereas most of the other Staatsmijnen shafts in South Limburg have been put down by the freezing process, the shafts of this fifth mine have been sunk by drilling. This method has the advantage that, even in very loose ground, wide and deep round holes can be drilled without the necessity of thei having to be lined immediately, provided they remain filled with a clay suspension or mud flush. This suspension has a higher specific gravity than water and deposits a clay coating on the shaft wall, thus permitting wide holes to be drilled without supporting the wall. Only when the shaft has been sunk to its full depth is the lining lowered and secured in position.

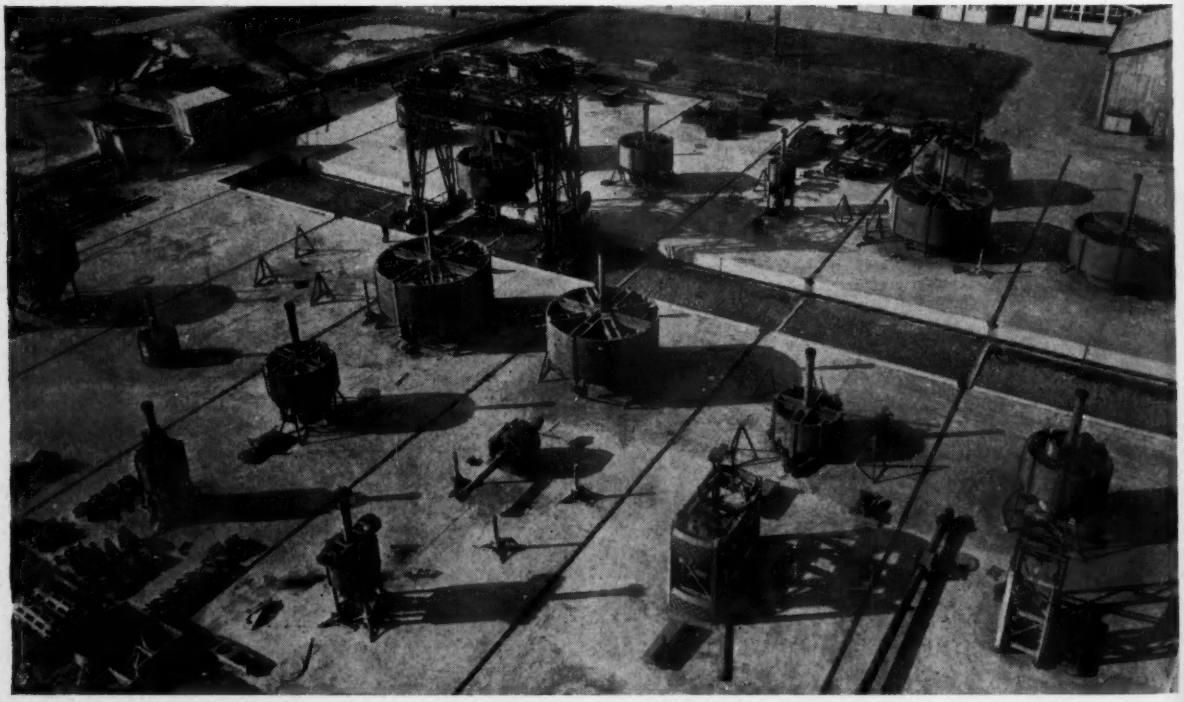
Frits Honigmann, whose name is well known in and around Heerlen, the headquarters of the Staatsmijnen, was the first to use the drilling process in the sinking of the shafts of the Oranje Nassau Mines I and II. For the sinking of wider and deeper shafts, however, stronger and heavier drilling equipment became necessary. Especially when sinking through hard rock, boring proceeded very slowly and, for this reason, after a successful start, the Honigmann process was, for some time, abandoned in favour of the freezing method. About 1920, the drilling process, improved by De Vooys, was re-adopted for constructing five collieries in a new coalfield in Germany. Much heavier and better drilling equipment was constructed which made it possible to use a relatively cheap drilling method and, moreover, to put in better shaft linings. Contrary to the freezing process, the drilling method permits the lowering of the lining in one piece and this offers a wider choice of materials and construction.

The heavier drilling equipment proved very satisfactory and it was used for sinking five new shafts, two of which were constructed in Holland. These were shaft No. III of the Hendrik Mine in the early thirties and shaft No. IV at the Emma Mine in 1949/51, both collieries being owned by Staatsmijnen.

Equipment Employed

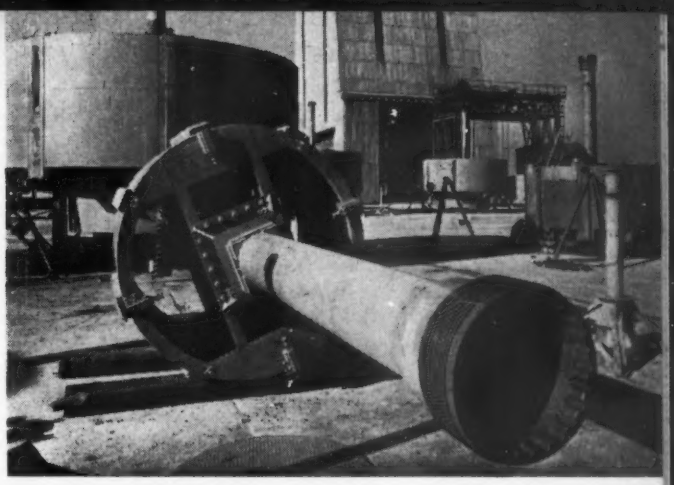
For the sinking of the deeper Beatrix mine shafts, however, this equipment was still not good enough and the Staatsmijnen engineers accordingly designed still more powerful drilling

Below are shown drills assembled on the platform near the shafts of the new Beatrix Mine. Crane in the centre carries the drills to and from the derricks



Drilled Colliery Shafts

What are claimed to be the two largest drilled colliery shafts in the world have recently been completed at the Netherlands State Mine Beatrix, which is under construction at Melick-Herkenbosch, Central Limburg, Holland. This vast project was completed after four years of work and preliminary work had been started on the first underground floor. The present coal situation in Europe, however, has led to controversy as to the advisability of continuing work on the mine, and it is possible that further development will be postponed. The mine was due for completion in 1962.



equipment by which a higher drilling speed could be achieved. Previous experience proved useful in dealing with the Beatrix shafts linings which, for each shaft, consists of two heavy steel cylinders of different diameter, one being placed inside the other so as to form a double walled tube. The steel cylinders, fabricated in a plant at the site, consisted of assemblies of rings, joined to form sections of 3.60 m. in height. In all, 272 outer sections and 264 inner sections were made and used. To join the inner sections, half a million nuts and bolts have been needed and a million holes had to be drilled. In addition 54 km. of welding joints were made for connecting the outer sections and for butt-welding the U-profiles.

When the shaft was put down to its full depth, the cylindrical sections were joined together at the shaft mouth and the tube thus formed closed at the bottom with a concrete plug to keep it floating on the mud flush. Every time a section was added the lining increased in weight and gradually sunk further down. The rate of sinking was controlled by pumping so much " ballast water " into the cylinder as to keep the top of the cylinder flush with the bank level so that the next section could be attached at the shaft mouth. When an outer and inner section had been added, the annular space between them was filled with concrete.

At top right is shown one of the drills used in sinking the Beatrix Mine shafts, while above, in centre, one of the shaft linings is under construction

Drilling of the new Beatrix shafts has involved the excavation of 22,000 cu. m. of earth from each shaft. Sinking has been done in two stages : first the borehole was drilled to a small diameter and then gradually widened with drills of increasing diameter. Before completion, over 6,000 tons of U-beams, 10,000 m^3 of concrete and 6,500 m^3 of bitumen were used.

The decision to build the mine was taken on February 19, 1952, a trial boring to 1,200 m. on the site of the planned shafts being started in the course of 1953. Drilling was completed early in 1959 and lowering of the lining begun. The final outer wall of the borehole has a diameter 70 cm. less than that of the borehole. This left a space of 35 cm. between the outer cylinder and the shaft wall to be filled later with bitumen. The diameter of the inner cylinder is 5.80 m. at the top and 5.60 m. at the bottom. The bitumen, outer steel tube, concrete and inner steel tube together form a continuous, watertight and slightly elastic tubing and this lining, it is claimed, will stand much less danger of being damaged by ground movements than the more rigid linings of the older shafts.

Future Programme

With the completion of shaft sinking at the Beatrix mine it was intended to make a start on the excavation of the sumps, the building of shaft stations and the driving of stone drifts and cross headings. At the same time, surface buildings were to have been erected, the most important of which were the shaft towers with the winding gear, the top landings, the screening, washing and loading stations and workshops. All this would have required an investment of 200-300,000,000 guilders and it would have taken about eight years before the Beatrix Mine would reach full production.

In October last, however, the Dutch Minister of Economic Affairs had a special discussion with the general management of Staatsmijnen in Limburg on the subject of the continuance of construction work at the Beatrix Mine in view of the present conditions obtaining in the market for coal. The general management had arrived at the conclusion that, under present circumstances, further development of the Beatrix Mine would involve considerable annual loss. It was recommended that activities at the mine be reduced to a further exploration of the coal resources in this region, the completed shafts to be conserved for an unlimited period, so that it would be possible to proceed with the work at a maximum rate whenever this should be considered advisable. The proposals of the general management are being taken into consideration by the Minister.

The Nicaro Nickel Ores

The results of mineralogical research on the Nicaro (Cuba) nickel ores and plant products are given in a report by R. B. Fisher and W. M. Dressel, published by the U.S. Department of the Interior as Bureau of Mines Investigation 5496. The report presents the physical and chemical characteristics, mineral associations, differential thermal analyses in controlled atmospheres, and X-ray studies of the ores and plant products.

IN the latter part of the 1955 fiscal year and during the 1956 and 1957 fiscal years, the Bureau of Mines, the Nickel Processing Corporation, and the Battelle Memorial Institute conducted research investigations on Cuban nickel ores and Nicaro plant products in accordance with an agreement with the G.S.A. The objectives of this research were to improve extraction of saleable nickel and to develop information on the technical and economic feasibility of recovering cobalt, iron, and chromium from the laterite ores.

The Nicaro nickel-leaching plant is owned by the Cuban Nickel Company, a corporation owned by the U.S. Government. Within the Federal Government, the G.S.A. is responsible for operation of the plant, although the Nickel Processing Corporation manages the Nicaro operation. The plant is in the northern part of eastern Cuba, where there are important reserves of nickel ore in ore bodies of nickel-bearing laterite underlain with altered serpentine of ore grade.

The U.S. Government is offering the Nicaro plant for sale, and it is understood that purchase proposals have been received from several bidders. The Cuban Government has intimated its intention of bidding for the plant.

These studies were made under a co-operative agreement with the General Services Administration (G.S.A.) of the U.S. Government. The purpose of the investigation was to obtain fundamental data that would be useful to other G.S.A. contractors concerned with the Nicaro ores in their research on reduction roasting, leaching, and other phases of the project ; and to the metallurgical staff of the Nicaro plant in Cuba. The overall objective of the combined research was to provide data to accomplish metallurgical improvement in the operations of the U.S. Government-owned plant at Nicaro, Oriente Province, Cuba. Particular emphasis is placed on improving the recovery of nickel from the ores and on the possibility of recovering other valuable constituents, especially cobalt.

Nickel recovery at the Nicaro plant depends upon numerous operating variables. The chemically combined nickel in the serpentine and laterite must be efficiently converted to the metallic state by a reduction roast. Magnesia in the ores must be fixed during the roasting process in the form of insoluble magnesium silicate. The amount of sponge iron produced during the reduction roast must be held to a minimum, for metallic iron will reduce the efficiency of the leaching operation. In addition, maximum recovery is limited by specifications on the cobalt content of the final product which require that the cobalt in nickel-oxide must not exceed 1 per cent.

Much of the information contained in this report depends on differential thermal analysis. Data obtained by this procedure can be of vast use to industries employing calcination, reduction roasting, or leaching. One of the purposes of this report is to reveal the possibilities of differential thermal analysis as an aid in the control of plant operations. The method can portray graphically the thermal reactions that take place in plant feed during roasting in air and in neutral or reducing gases and the temperature at which the reactions occur. It is a means of checking roasting operations by analysing plant products to determine the cause of plant losses.

Nickel occurs in three ways in Nicaro ores : (1) As a combined constituent in the serpentine minerals ; (2) as dark brown to black incrustations and replacements associated with cobalt, manganese, and iron oxides ; and (3) as nickel-bearing goethite. The nickel is distributed rather evenly in the basic iron oxide and appears to be in a compound, in a relatively small amount, such that it can replace iron in the goethite structure.

Cobalt, with iron and nickel, occurs with the manganese oxide. It was found that when manganese is not present, neither is cobalt ; however, manganese can be present in the absence of cobalt. The manganese seems to have played an important role in trapping cobalt during lateritization. The cobalt could have been derived from alteration of a previously existent mineral in the basic rock before the rock was altered to serpentine and laterite.

Part of the alumina is accounted for by its presence in chromite and in altered serpentine. Some alumina could also be present in the form of aluminum hydrate, clay, or in the structure of the goethite.

High nickel values are always found in the portions of the tailing, which show a high percentage of altered and heat-treated serpentine. This relationship indicates that the nickel in serpentine grains is more difficult to extract than from the basic iron oxide. The loss of nickel in the tailing could be caused by : (1) The serpentine not completely broken down structurally so as to allow all the nickel constituent to be properly reduced to the metallic state for extraction by subsequent leaching ; (2) reduced nickel mechanically held in the grains so that the leach solution cannot attack it ; (3) nickel precipitated from plant solution by sponge iron or with ferric hydroxide ; and (4) nickel combined in forsterite. The first and fourth causes were substantiated by tests in which nickel was recovered by a re-reduction roasting and leaching treatment of non-magnetic plus-325-mesh material from the first Nicaro plant tailing and by observing heat-treated grains in the tailing having fairly high indices of refraction, indicating forsterite.

Since the nickel is chemically combined in the altered serpentine, the altered serpentine must be totally broken down chemically. The temperature at which the altered serpentine must be heat-treated, before the reduction roasting becomes effective, lies in the range of 600 deg. to 815 deg. C. The altered serpentine actually starts to decompose before the 600 deg. C. temperature is reached.

Uniformity of particle size is very important in reduction roasting, because it prevents under-roasting of coarser sizes, which does not reduce all of the nickel constituent, and over-roasting of finer sizes, which will produce excessive leach soluble iron.

The nickel must be reduced to the soluble form of elemental nickel for extraction by leaching, but over-roasting tends to produce leach-soluble iron that will cement out dissolved cobalt and nickel, or the dissolved iron may oxidize and precipitate as ferric hydroxide, a precipitate which tends either to coprecipitate nickel and cobalt, or to occlude a substantial amount of nickel and cobalt ions.

Furthermore, to obtain the maximum reduction of the nickel in the altered serpentine commensurate with high recovery, the optimum relation must be established among (1) Reduction roasting rate of heating in the range from the point

at which the serpentine lattice breaks down to that at which forsterite forms, (2) the amount of sponge iron formed, and (3) the amount of nickel lost in the forsterite structure. More research is required to determine the form in which nickel becomes fixed in the forsterite. The research contractors have shown by laboratory tests that nickel recovery decreases when the altered serpentine is reduction roasted above approximately 810 deg. C. A relatively slow rate of heating is more beneficial than a fast rate of heating. In the 600 deg. to 815 deg. C. ranges, enough time must be allowed to break down completely the serpentine mineral to free the nickel constituent from the silicate. Sufficient time must also be allowed for reducing the nickel constituent before the magnesia and silica become fixed again as forsterite. Fixation of the magnesia and silica prevents excessive magnesium compounds from being dissolved by the leach liquors, which will, in turn, precipitate as other magnesium compounds and cause troublesome scaling of plant equipment.

The presence of ferrous iron in the altered serpentine might be one contributing cause of the low nickel recovery. The iron in the altered serpentine ores is in both the ferrous and ferric states, the amount of ferric iron depending generally upon the degree of alteration of the serpentine minerals and the presence of residual and secondary iron minerals. When the serpentine mineral undergoes alteration, the ferrous iron oxidizes to basic ferric oxide and the nickel accompanies the iron, as indicated by the iron-nickel relation in the goethite of the laterite.

An initial operation of decomposing the altered serpentine and oxidizing the ferrous iron to the ferric state would produce a minimum amount of sponge iron and a maximum reduction of nickel during reduction-roasting. This procedure would require an oxidizing roast of the altered serpentine to a temperature somewhat above that at which its lattice is destroyed, and it could be combined with the drying operation. The reduction roasting could be carried out at an appreciably lower temperature. Such an operation could contribute materially in increasing the nickel extraction from the altered serpentine.

AUSTRALIAN MINE TAXATION—IV

Depletion in Mine Taxation

A series of three articles by Dr. Dunn on the subject of taxation appeared in previous issues of this journal. In this article—reproduced by courtesy of *Chemical Engineering and Mining Review*, the history and basis of depletion are briefly reviewed.

A MINERAL DEPOSIT, whilst being mined, is a depleting asset* ; each unit removed has a capital value at the moment of its removal. The annual capital value of the mineral removed is represented by the " depletion allowance " which, the mineral industry claims, should be deducted from mine revenue before true taxable income is determined.

The history of depletion is associated largely with the United States, where depletion was first explicitly recognized in the Revenue Act of October 1913. Under that Act, 5 p.c. of the gross value of the output of a mine or oil well was allowed as a deduction in determining taxable income. However, in some cases the original cost of the property could not be recovered by this method during the life of a mine. Under the Revenue Act of 1916, a revised basis permitted recovery of the original invested capital over the life of the mine ; the annual depletion allowance was calculated as a proportion of the capital cost of the deposit, in the same ratio as that of the tonnage of mineral mined to the total recoverable reserves.

In 1918, to encourage prospecting, the basis of the allowance, on deposits discovered subsequent to March 1913, was fixed at the fair market value of each deposit within 30 days of discovery. However, this gave rise to problems related to the definition of a new deposit, and, in the Revenue Act of 1926, the allowance for petroleum and natural gas was based on a percentage (27½ p.c.) of gross income from sales, up to a maximum of 50 p.c. of the net income. As a result of a detailed inquiry by a U.S. Joint Committee on Internal Revenue Taxation 1930-31, this method of " percentage depletion " was extended to other minerals as an alternative to the former assessment based on " discovery " value, and in 1932 the depletion allowances, based on gross revenue, were : coal 5 p.c. ; metals 15 p.c. ; and sulphur 23 p.c. ; subject in all cases to a maximum of 50 p.c. of net income.

During World War II, in order to encourage the production of other minerals, percentage allowance was extended to barite, beryl, ball and saggar clays, felspar, fluorite, flake graphite, lepidolite, mica, potash, rock asphalt, spodumene, talc and vermiculite, at the rate of 15 p.c. After the war, percentage allowance at 15 p.c. was further extended to bauxite, bentonite, china clay, gilsonite, phosphate rock, pyrophyllite, thenardite, and trona. Under the Revenue Act of 1951, coal was raised to 10 p.c. and percentage allowance was extended to 35 additional minerals at rates varying from 5 p.c. to 15 p.c. of the gross income, the maximum limit of 50 p.c. of net income being retained.

" Discovery " depletion had been continued side by side with " percentage " depletion, but, in the Revenue Act of 1954, percentage depletion was applied to all mineral production other than from inexhaustible sources.

Gross revenue from mine production has been defined as that from the " first marketed product ". But the " first marketed product " may refer to stages of treatment which may range widely for different mines — this has occasioned problems relating to what may be accepted as " ordinary treatment processes " in mining. Where operations go beyond ordinary treatment processes attributable to mining, the cost and income apportionable to mining must be calculated commonly on an arbitrary basis. The distinction between mining and non-mining operations, for the purpose of determining depletion allowance, has recently been under technical consideration in the United States.

The division of mining operations amongst several leases in many cases, and the liability of certain capital gains to taxation in the United States, raise further problems on what constitutes property for purposes of determining depletion allowance.

By Dr. J. A. DUNN

* The term " wasting asset " is commonly used, but is a misnomer and probably partly responsible for misunderstanding of the basis of depletion allowance. The term " depleting " or " consumable " asset is to be preferred.

In Canada, depletion allowance is based generally on a percentage of profits (as distinct from the U.S. basis on gross revenue) and has been a permissible deduction from mine income since at least 1915. The amount is 33⅓ p.c. of the profits from a metalliferous mine, oil or gas well, or non-bedded deposit ; $4.00 per oz. of gold or 40 p.c. of the profits from a gold mine, whichever is greater ; and 10 cents per ton of coal produced from coal mining. In the case of a bedded deposit, the capital cost is amortised annually over the productive life of the deposit, in the ratio of annual production to total reserves.

Recognition of depletion allowance has spread to many countries, particularly where it is desired to provide some form of incentive to mineral development. The form of the allowance varies according to the fiscal system of each country.

Although depletion allowance has never been recognized as such in the Australian Income Tax Act, Section 23A does provide an allowance on income from those minerals to which the Section applies, similar in effect to the Canadian allowance. Section 23A was introduced during the war to encourage production, at a time when the income tax was sharply increased. The Section was continued after the war on a temporary basis, and is at present current only to June 30, 1960. The Section has not been applied to an important group of metals : lead, zinc, silver, cadmium, and iron, and to coal.

That depletion has been long explicitly recognized in the U.S. and Canada, where mineral development has been brought to the highest scale of production, yet remains unrecognized in Australia, where intense mineral development is vital to the general development of the country, provides an interesting contrast.

So far as the writer is aware, from discussion on the subject over the years, it has never been denied that a mineral deposit has a capital value, or that the capital value may be subject to increase consequent on development and other factors. The objection is based on the contention, as stated by the Commonwealth Committee on Taxation, 1950, " that the capital asset so returned should be the capital invested, and not an estimated amount intended to represent the appreciated value of the mine ". Consistently, the thinking in opposition to percentage depletion allowance is along the lines of depreciation, which is related to the reduction in quality or usefulness of a replaceable asset, rather than of depletion which is related to the reduction in quantity, or the consumption of an irreplaceable asset. Such thinking insists that accountancy principles applied to depreciation must also be valid for depletion — not unlike the kind of thinking which has long refused recognition of the significance of obsolescence.

It is not the intention to discuss in this article the arguments for and against depletion allowance. Many analogies can be drawn to justify the acceptance which has been granted to it in so many countries. However, it may be of interest to illustrate by a simple case, the sort of anomaly which arises in the absence of an allowance of the depletion type.

A mineral deposit may be developed after brief prospecting from minor surface indications. Its initial asset value may have been virtually nil; but, as a result of mine development and production over a period, the deposit as such may acquire a considerable value. The owner may, at this stage, decide to sell the deposit at its market value, and the sale price of the ore reserves, their capital value, may be exempt from tax, under Section 88B — to that extent the mine owner would be in precisely the same position as the owner of real estate who is not taxed on any increase in the value of his property on its sale. If, however, the miner decided to continue to work the mine, the capital value of every unit of ore removed is taxed. In other words, we have the anomalous position that the capital value of each ton of ore is not taxed if sold attached to the deposit, but is taxed if detached from the deposit.

Percentage depletion is quite soundly based on the principles which underlie mine valuation. The present value or purchase price of a mine is, of course, related to present and prospective net revenue, and to the rate of interest commensurate with the risk attached to investment in the particular mineral deposit. Formerly, such valuation was commonly based on the Hoskold formula, which took into account the three factors : net revenue, the " risk " rate of investment for the particular deposit, and the " safe " or bond interest rate.

However, the annual surplus, after deducting all charges, may be regarded as divisible into two parts : that representing the return of the capital value of the mineral extracted during the year, and the remainder representing the true profit which should give a return in keeping with the speculative or risk rate of interest expected on the particular orebody.

The part representing capital return is the allowance for depletion. It may be regarded as a sinking fund, f, which, if invested annually at a " safe " (or bond) rate of interest, i (expressed as a fraction), will accumulate to the capital value of the deposit on its exhaustion in x years. Then, in terms of unit capital value :

$$f = i/[(1 + i)^x - 1]$$

For a " speculative " interest return, r, (also expressed as a fraction)

$$\text{the annual surplus} = f + r$$

and the depletion allowance, d, may be expressed as a proportion of the annual surplus :

$$d = f/(f + r).$$

With the bond rate at 5 p.c., the following examples illustrate the incidence of depletion.

1. Assume a deposit with 10 years' reserves, expected " risk " rate 10 p.c. :

$$f = .05/[(1.05)^{10} - 1] = .08$$
$$\text{annual surplus} = .08 + .10 = .18$$

and the depletion allowance is

$$d = 8/18 = 44 \text{ p.c.}$$

2. Assume a deposit with 20 years' reserves, and " risk " rate 15 p.c.

$$f = .05/[(1.05)^{15} - 1] = .03$$
$$\text{Depletion allowance } 3/18 = 16\text{-}2/3 \text{ p.c.}$$

It is apparent that for deposits containing extensive proved reserves, with which would go a reasonably low interest rate, the depletion allowance may be justifiably low. But for deposits of a traditionally high speculative rate, associated generally with relatively small proved reserves, the depletion allowance should be higher. Thus, there may well be a case for grouping minerals into certain rates of depletion : e.g., limestone, coal at a low rate ; lead, zinc and copper at a medium rate ; and tin, tungsten, and beryl at a high rate.

However, it is the usual practice to choose an average representative allowance, such as the Canadian 33⅓ p.c. Section 23A of the Australian Income Tax Act may be regarded as providing a depletion allowance of 20 p.c. for the minerals to which it applies, but with the reservations discussed in the previous articles of this series.

MINING MISCELLANY

Work at Pahang Consolidated deep tin lode mine in Malaya was suspended from November 13-17, owing to a very severe cloud-burst, when 4½ in. rain fell in 1½ hrs. The mine plant and equipment did not suffer damage, but the railway to Kuantan, and the road was damaged. Altogether about 50 landslides were reported from the area. The railroad should be restored within a month, but the road will take about six months to reconstruct.

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The Geological Survey Bureau of the Board of Industrial Science and Technology of Japan announced recently the discovery of a promising deposit of uranium just north of Tazawa Lake in Akita Prefecture, said to compare favourably with that at Ningyo Pass in Tottori Prefecture. The uranium content of the new deposit is from 0.4 to 0.64 per cent, which compares with an average of 0.05 per cent at Ningyo Pass. The board has now revealed that uranium deposits were located at the village of Asahi, in Yamagata Prefecture, in August of last year, and at the town of Nakajo, in Niigata Prefecture, in November of last year. There are thought to be strong possibilities that uranium may be contained in neocene strata extending from the south-western part of Hokkaido to the Sanin District.

★

The South Korean Ministry of Commerce and Industry, and the Association for European Trade promotion have jointly drafted a plan in Seoul to promote South Korea's export trade to western European countries. According to the Ministry, the plan calls for an export volume of U.S.$3,754,000 in 1960, and aims to export among other commodities, tungsten, molybdenum, bismuth, iron, iron ores and electrolytic copper.

★

The Greek Government Commission which has been in Western Germany for two months, negotiating with German concerns on the carrying out of mineral exploitation and production in Greece under a German credit scheme involving some £1.250,000, reports that it has virtually completed its work. The German concerns are to plan for the following schemes: exploitation of the Ptolemais brown coal field and the supplying of Ptolemais with water; exploitation of brown coal deposits at Megaloupolis, in the Peloppenes; production of superphosphate from local raw materials; production of iron and steel, and manganese iron. No orders have yet been placed for mining of zinc and bauxite in Greece.

★

Spain has put its first uranium plant into operation, it is announced from Madrid. The plant is at Andujar, in the province of Andalusia, and uses uranium-bearing ore produced locally at the rate of 200 tonnes daily.

★

Under a new trade agreement signed in Moscow recently, France will export Frs.52,000,000,000 worth of goods to the Soviet Union in 1960, and import Frs.50,000,000,000. This is claimed to be the first time that the U.S.S.R. has agreed to accept imports not covered by exports. The agreement is part of a three-year trade pact, and under it French imports of oil are reduced to allow for growing Saharan production. A high proportion of the exports to the Soviet Union will be capital goods; France will considerably step up her purchases of Soviet tin during 1960, and will also receive anthracite, manganese and chrome.

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Intensive geological work, followed by diamond drilling, has disclosed a new iron orebody directly below Fosdalens Bergverks A/B's mill, and this Norwegian company is to drive a 4,000 ft. circular shaft, with an inside dia. of 20 ft., to the deposit. It is not expected that the new mine will be producing ore to full capacity under eight years, and in the meantime ore will be supplied from the western mine, which is expected to maintain supplies until the new mine is under way, although its reserves are dwindling. The new deposit is claimed to have reserves for about 15 year's production.

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The Smith Tool Co. of California, U.S., manufacturers of drilling bits for petroleum mining and water well drilling is to lease a manufacturing plant in Blantyre, Scotland, employing about 250 people.

★

Non-ferrous metal mines of the U.S.S.R. are to instal industrial TV apparatus states *Moscow News*, to enable the mine lift operator at the surface to watch miners below getting in and out of the lift, and also to keep a watching eye on proceedings in the mine and stockyards. Mines reported to be using this installation are the Ust-Kemenogorsk Lead - Zinc Combine in Kazakhstan, and the lead works at the Leninogorsk Inter-Metallic Ores Combine.

★

Delegates from the Coal Committee of the Organization for European Economic Co-operation met in Luxembourg last week to study the coal situation in the Coal and Steel Community in the first quarter of 1960. The production forecast is for a drop in output of some 2,500,000 tons, compared with the same period in 1959, but this estimate did not take into account the effects of short-time working.

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The Minister of Power proposes to make Miscellaneous Mines (Explosives) Regulations, 1959, which are being circulated in draft form, come into operation on April 1, 1960. Part III of the regulations prohibits the firing of shots below ground except by competent persons, who must not be under the age of 21, appointed for the purpose by the manager of the pit. Colliery managers are reminded of their obligation under Section 88 of the Mines and Quarries Act, 1954, to see that the persons they appoint are properly trained.

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A new copper flotation plant has been brought into operation at Malko-Trovno, a small town on the Bulgarian-Turkish border. The plant is said to have a processing capacity of up to 350 tonnes of copper and iron ore daily.

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A start is to be made on the exploitation of soda deposits discovered in the Lake Van region of eastern Anatolia, Turkey, and a plant will be set up there to process crude soda. Since the combined national soda consumption of Turkey is not above 20,000 tonnes a year, and the plant will have an annual capacity of 70,000 tonnes, Turkey is expected to become an exporter of soda to neighbouring countries.

★

Bleikvassli Gruber and Mofjellet Gruber, two of Norway's leading producers of zinc, lead and copper concentrates, announce that they have already sold their entire 1960 output to buyers in Western Germany. Estimated production figures for 1960 are 15,000 tonnes of zinc concentrates, 4 - 5,000 of lead concentrates and 1,000 tonnes of copper concentrates.

★

Recent reports state that twelve of Korea's copper mines are to be closed, and the remaining eight or nine subjected to drastic production cuts, as their production rate is uneconomic at the (then) existing copper prices. The Changhang operation, which has an annual capacity of 80,000 tonnes, is producing only a negligible amount. Reports from Washington state that projects are under consideration in South Korea involving the expenditure of $U.S.1,000,000 on iron ore production, $3,000,000 on ironworks, $2,370,000 on a salines production scheme and $750,000 on a scheme for the output of thorium.

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Engineers of the Nippon Mining Co., Japan, are to investigate reported rich copper claims in Malitao, Mountain Province, Philippines, owned by the Apayao Mining and Oil Co. The Bureau of Mines has reported that the area is highly mineralized, and ore brought to Manila showed high percentages of copper.

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The Chungliang Mountain coalfield in China, with an annual production capacity of 1,800,000 tons of coal, has gone into production. A pit capable of producing 900,000 tons of coking coal annually has been completed at the Feng Feng colliery, as has another at Pingting-shang colliery in Honan. A new opencast mine with an annual capacity of 600,000 tons has started production at Tungchuan, in Shensi Province.

★

The Institution of Mining Engineers gives the following results on candidates entering for the examinations for National Certificates in Mining and Surveying, entries for 1959 being 15 per cent greater than in 1958. There were 1,836 candidates for the Ordinary National Certificate, including 378 mining surveyors, 338 mining mechanics and 432 mining electricians, drawn from every coalfield in Britain; of these 59 per cent passed. For the Higher National Certificate in Mining, 377 entered, of whom 265 passed. (70 per cent.) For the Higher National Certificate in Mining Surveying, there were 219 candidates, of whom 147 (67 per cent) were successful. The only group to show a decrease in numbers were candidates for the National Diploma in Mining, where 167 entered, with 130 passing (78 per cent). These examinations are assessed by the Institution of Mining Engineers and the Royal Institution of Chartered Surveyors, acting jointly with the Ministry of Education and the Scottish Education Department.

Machinery and Equipment

Hydraulic Ram with Independent Control Valve

An improved hydraulic ram for face conveyers, claimed to offer a number of important advantages, has been developed by Richard Sutcliffe Ltd.

The ram cylinder is made from solid drawn tube, the bore being smooth honed to size — a method which prolongs the life of the piston packings and seals. The piston rod is ground to size and electrolytically coated with hard chrome to increase the wear life of the rod and packings and to provide protection against corrosion. Synthetic fabric reinforced seals together with the polished rods and honed tubes, eliminate leakages, making it unnecessary to fit a high rate delivery pump.

The control valve is independent of the ram and is mounted on the adjacent gooside plate. Made from high grade iron casting, the valve body is fitted with a polished hardened steel rotary piston on well tried plug cock principles. The seals are drained and there are no plastic plates to wear. The valve has three positions — ram-out, neutral, and ram-in. In neutral the ram can be disconnected without loss of oil, leaving the system undisturbed.

Small and compact, the valve may be fully housed in a channel section attached to the gobside plate. It is unnecessary to provide a special gobside plate to receive the ram because the channel section is drilled to accept both the ram and control valve and may be fitted on any section along the conveyor. The channel can accept the ram in three positions, an advantage which is beneficial to prop setting in relation to the ram.

The hydraulic ram with independent control valve by Richard Sutcliffe Ltd.

DETERMINING CARBON MONOXIDE CONTENT

A new device for determining carbon monoxide is under development at the recently opened Research Laboratories of the Cambridge Instrument Co., Ltd. This device employs an extension of the method whereby a catalyst is used to promote the oxidation of carbon monoxide in excess air, the resulting temperature rise during the exothermic reaction being used to estimate the amount of carbon monoxide originally present.

The novel test-cell design under development enables a high sensitivity and rapid response to be obtained with low rates of gas flow. The apparatus dimensions are much reduced compared with those of some of the earlier equipment produced by the company.

A SMOOTH BLASTING TECHNIQUE

In order to obtain fine even contours after blasting with high explosives, a technique has been developed in Sweden which is known as smooth blasting or smoothing. This has been achieved following a number of investigations which have led, among other things, to the production of charges specially suitable for smooth blasting. The technique has been described in *Water Power* of May, 1959, by Ulf Langefors, Nitroglycerin A.B., Stockholm.

Among the tests carried out to obtain smooth crack-free rock faces were practical experiments by Hagthorpe and Dahlborg at one of the underground establishments in the Stockholm area of the Royal Fortification Administration; preliminary tests on rock by the Physical Research Laboratory of Nitroglycerin A.B. in collaboration with Stockholm Harbour Board; and plexiglass scale-model blasting by Langefors and Lundborg. Similar tests have been made by the Royal Fortification Administration in collaboration with Nitroglycerin A.B. and Atlas Copco A.B.

To reduce cracking of the rock, the section of rock to be blasted should not be too tightly wedged to avoid the use of an unnecessarily large quantity of explosive. The placing of holes and the detonating sequence must be such that the rock is blasted away successively with breakage towards the free surfaces. For contour holes, the correct size of charge should be used and its concentration adjusted correctly in the drill hole. In using the smaller charge concentration the plexiglass is slightly damaged round the drill hole and only a few cracks have extended to the full length. To a certain extent, these cracks can be guided in definite directions through special unloaded guide holes, thereby giving an even and satisfactory final contour.

Scale model blasting and practical experience have shown that, to give good results, the relation between the distance of the holes and the burden (E/V) should be about 0.8, i.e. the burden should not be too small compared with the hole distance. In full-scale rock blasting the effect of uncharged guide holes is greatest if the guide holes are placed from 10 to 20 cm. from the charged holes. The distance between the charged holes can then be 60 to 80cm. Normally, uncharged guide holes are unnecessary except in special cases, e.g. to obtain contours with a small radius of curvature (connection between wall face and roof, or similar).

Now available on the market, the special contour hole charges for smooth blasting consist of pipes about 0.5 m. long with a blasting charge of gurite. The charges can be joined together by sleeves to obtain the desired lengths and the external diameter at the joints would then be 18.5 mm. Charges for smooth blasting can also be made up from ordinary dynamite by cutting up the cartridges lengthways and putting them on a wooden rod so that the concentrated charge is less than 0.25 kg per m. This can be done by using 25 mm. cartridges, which, after being cut up lengthways, are placed 5 or 10 cm. apart on the wooden rod. Another charge which gives comparatively good results can be made with 10 cm. wooden pegs alternating with halved cartridges of LFB dynamite.

There should be a minimum of time spread in detonation between different

holes in a row. Where smooth blasting is carried out separately—after the rest of the round—the charges can be detonated by instantaneous electrical caps, short-delay caps of a lower interval number, or a detonating fuse. If the contour holes are part of a large round, the charges must then be detonated by electric caps of a high interval number with either a short delay or a half-second delay.

If the same delay number is used in doing this a certain spread in detonating time between the different holes will occur. Short delay caps give a spread of ± 10 millisec., half-second delay ± 200 millisec. (0.2 sec.) Short-delay blasting caps should be used for best results and this applies also to separate blasting of the final contour. If the detonating spread is not kept to a minimum the charges fired first may blow out charges from neighbouring holes before they are detonated.

Very little is usually gained in respect of the unevenness of the remaining face by spacing the holes less than 50 to 60 cm. apart. It is consequently not necessary to adopt extremely close drilling in order to obtain even and satisfactory rock faces. If very great evenness is desired in special cases, uncharged guide holes can be employed, using, if necessary, a small bottom charge. The distance between the charged holes need not be less than 60 cm.

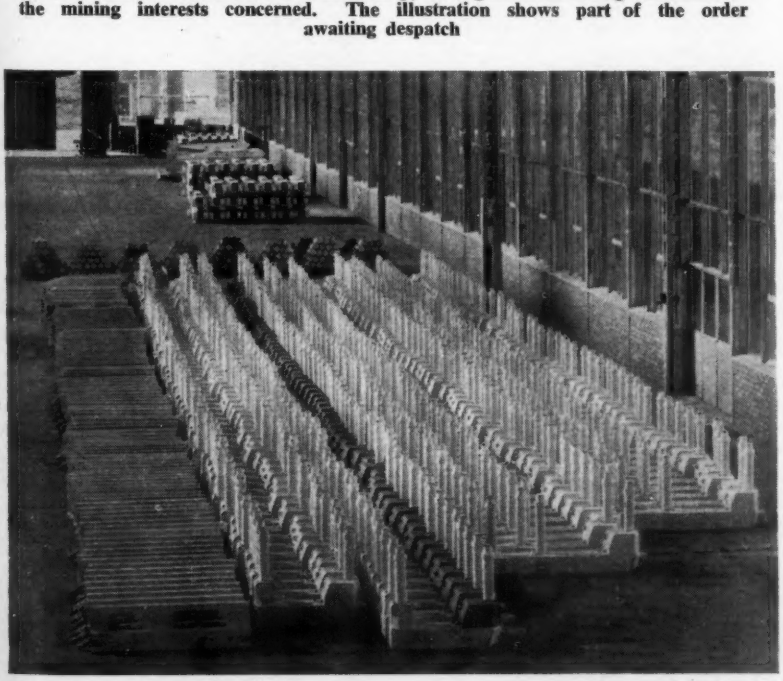
Favourable results are obtained from gurite pipe charges in normal rocks by using the following rules: distance of holes 60 cm.; burden 80 cm.; bottom charge 0.2 kg.; short-delay detonators of lowest possible interval number. These rules apply for roof and walls and for vertical holes in bench blasting where the rock mass has a free breakage. Where this is not the case, e.g., where there is a load of previously blasted rock, the charges must be increased to ensure breakage. This means that in blasting tunnels, smooth blasting of the lower part of the walls may not be possible unless the spoil is removed before the smooth blasting is carried out.

Homogeneous as well as unhomogeneous rocks can be cut very accurately along the desired final contour by smooth blasting. By employing this method hydraulic losses in water tunnels can be reduced; roofs and walls will be stronger and less chipping required; there will be less risk of falling rock and concreting of the actual rock face will be easier and less costly.

If large cracks and crevices run right through the rock, the exposed rock face will have corresponding irregular features. The chief advantage of smooth blasting in these cases is that further large cracks are avoided and existing ones do not become larger.

Recently, a bulk order for more than 30 miles of p.v.c.-coated Terylene ventilation ducting (fire-resistant in accordance with N.C.B. requirements) has been placed. This varies in diameter from 12 in. to 24 in. and has been stitched throughout with Terylene thread. Made up by Robert Watson and Co. Ltd., Newburgh, Fife, from a specially woven 2½ oz. per sq. yd. twistless Terylene base fabric produced by C. A. Newsholme and Co. Ltd., Keighley, Yorkshire, the ducting is about three times lighter than that formerly used. Its use results in easier handling, greater efficiency and longer life. The lightness of the coated Terylene fabric has found particular favour among the miners themselves, while its very high rot resistance and retention of tear strength are marked advantages where damp conditions prevail. Illustration shows an installation at Parsonage Colliery, Leigh

Dowty Mining Ltd., is now making delivery to Poland of an order for two complete coal faces of Roofmaster hydraulic powered support systems. The award of the contract was the result of a visit to this country last February of a party of Polish mining experts headed by the Minister for Mining and Power, Mr. Waniolka. The company had supplied hydraulic pit props to mines in Poland eighteen months ago, and thus Dowty engineers were invited to survey the Katowice coal fields in south-west Poland and advise the mining authorities there upon the installation and operation of the Roofmasters. The result of this was an order from Centrozap, an organization acting on behalf of the mining interests concerned. The illustration shows part of the order awaiting despatch



DICKOW PUMPS IN U.K.

Firth Cleveland Pumps Ltd., are to manufacture under licence the range of self-priming multi-stage centrifugal pumps designed and developed by Dickow-Pumpen of Western Germany. The British company will be able to sell the pumps in all parts of the world, with the exception of the Common Market Countries, Scandinavia and India.

Dickow pumps will now be called Firth Cleveland pumps.

Metals and Minerals

Metals In The Common Market

Of considerable importance to the metal industries is the scheduled survey being made for the European Coal and Steel Community, the results of which are expected to be made available early in the coming year. While this survey will be concerned primarily with the long-term outlook for the steel industries, it will also take in competing materials such as aluminium and other metals, as well as plastics, for the purpose of determining what inroads, if any, are to be expected by these materials in markets traditionally regarded as steel's preserves.

The survey, which can be expected to fill a number of gaps in existing knowledge of metal trends, should be very valuable, more especially since it comes at a time when the potential consequences arising from the establishment of the "Six" and the "Seven" cannot as yet be clearly discerned. In this context, the latest issue of Metallgesellschaft's *Statistical Tables*, covering the period 1949-1958, contains some most pertinent observations.

Negotiations on the implementation of the contract to create a European Economic Community (Common Market), have shown that there may be what amounts to attempts to foist the protectionist economic policy, subscribed to in the past by certain Common Market member countries, on the area as a whole, states the introductory chapter. It is pointed out that the metal industry itself, in some Common Market countries, enjoys considerable protection from the high import duties of their own national tariff rates. During negotiations to determine the import duties on metals and metal concentrates or ores from countries outside the Common Market (among others, aluminium, lead and zinc), the representatives of several countries expressed themselves in favour of especially heavy duties.

"In determining the tariff impositions on 'extra-Common Market' commodities, however", maintains our contemporary, "the interdependence of the Common Market area and the rest of the world must not be overlooked; nor the fact that the development of the economic life of the Common Market area as a whole, must take precedence over individual wishes for protection for specific raw materials. It is in the interests of the entire Western World that the Common Market area should not form an autarchy within the West's economic framework as such, and that trade between its members and outside countries should be increased and not reduced. Hence the negotiations with the object of creating a Free Trade Area.

"It is to be hoped that the initiative of the seven European countries—Great Britain, Sweden, Norway, Denmark, Switzerland, Austria and Portugal—to establish a so-called small Free Trade Area, will eventually lead to the creation of the large Free Trade Area, which will embrace all the countries of Western Europe and the Common Market. The latter should avoid all action which might prejudice this step, even the fixing of protective duties on raw materials in the 'extra Common Market Tariff Scale'."

Production of the six most important non-ferrous metals in the West dropped from approximately 11,120,000 tonnes in 1957 to 10,730,000 tonnes in 1958 — a drop of roughly 3½ per cent. In the case of aluminium, however, it rose from 2,750,000 tonnes in 1957 to 2,810,000 tonnes in 1958. Consumption was only slightly less than in 1957. There was an increase of roughly 3.5 and 0.08 per cent in the consumption of aluminium and copper respectively, whereas the consumption of nickel declined by 25 per cent, that of tin by 4 per cent, of lead by 3 per cent, and of zinc by 2 per cent. Production, despite limitation, still exceeded consumption. The production surplus of all six metals together amounted to approximately 700,000 tonnes.

After noting that both production and consumption of metal in 1959 will be higher than in the previous year, it is emphasized that, should the demand increase, there will be no shortage in the foreseeable future, since in all metal fields there are as yet unexploited production capacities available.

ALUMINIUM AND BAUXITE

The United Steel Workers' Union announced that wage talks with the major aluminium producers were to be resumed on Wednesday, December 9, and that it would seek an agreement along the lines of the contract signed in October with Kaiser Steel Corporation, the sister company of Kaiser Aluminium. It is said that if the move is successful, the aluminium contracts will be used in an attempt to wrest similar concessions from the steel producers.

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Mr. Walter Nash, Prime Minister of New Zealand, recently met three Australian representatives of Consolidated Zinc Pty. for discussions on the establishment of an aluminium smelting works in South Island, using Lakes Manapouri and Te Anau as sources of hydroelectric power. Mr. Nash said that the government was not as yet ready to sign an agreement with the company and that the terms of agreement were still under consideration. The scheme is linked with Consolidated Zinc's large-scale plans for exploiting the huge bauxite deposits in the extreme North of Australia.

The scheme would establish a £60,000,000 aluminium works in New Zealand. Powering the proposed scheme would involve raising the level of Lake Manapouri in Southland Province by 100 ft. and connecting it with Lake Te Anau and providing a hydro-electric power station at a depth of 600 ft. below surface. Such a scheme would offer the attraction of cheap and ample power.

The project has raised comment in Queensland and the fear of diversion of the industry from that State has been expressed. The agreement between the State of Queensland and Commonwealth Aluminium Corporation, which is developing the Weipa bauxite deposits, provides that aluminium oxide will be produced in Queensland. That being fundamental, it

LONDON METAL AND ORE PRICES, DEC. 10, 1959

METAL PRICES

Aluminium, 99.5%, £180 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 9s. 6d lb.
Cerium (99%) net, £16 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 14s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 250s. 5½d.
Iridium, £23/£25 oz. nom.
Lanthanum (98%/99%) 15s. per gram.
Manganese Metal (96%/98%) £245/£250
Magnesium, 2s. 0d./2s. 3d. lb.
Nickel, 99.5% (home trade) £600 per ton
Osmium, £21/£23 oz. nom.
Osmiridium, nom.
Palladium, £8 12s. 6d.
Platinum U.K. and Empire Refined £28 10s. oz.
Imported £27/£27½
Quicksilver, £71½/£72 ex-warehouse
Rhodium, £41/£45 oz.
Ruthenium, £18/£20 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 80½d. f. oz. spot and 80d. f'd
Tellurium, 18s. lb.

ORES AND OXIDES

Antimony Ore (60%) basis	19s. 6d./20s. 6d. per unit, c.i.f.
Beryl (min. 10 per cent BeO)	220s./230s. per l. ton unit BeO
Bismuth	30% 5s. 0d. lb. c.i.f.
	21% 3s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable 48% (Ratio 3 : 1)	£15 15s. 0d. per ton c.i.f.
„ Hard Lumpy 45% (Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
„ Refractory 40%	£11 0s. 0d. per ton c.i.f.
„ Smalls 44% (Ratio 3 : 1)	£14 0s. 0d. per ton c.i.f.
Baluchistan 48% (Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1). Nb_2O_5:Ta_2O_5	170s./180s. per l. ton unit c.i.f.
Fluorspar—	
Acid Grade, Flotated Material	£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)	156s. 0d. ex. works
Lithium Ore—	
Petalite min. 3½% Li_2O	40s. 0d./45s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O	40s. 0d./45s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O	£25 0s. per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
Manganese Ore Indian—	
Europe (46%-48%) basis 6/s. 6d. freight	73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)	nom.
Molybdenite (85%) basis	8s. 11d. per lb. (f.o.b.)
Titanium Ore—	
Rutile 95/97% TiO_2 (prompt delivery)	£29 per ton c.i.f. Aust'n.
Ilmenite 52/54% TiO_2	£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	147s. 6d./152s. 6d. per unit c.i.f.
Vanadium—	
Fused oxide 95% V_2O_5	8s./8s. 11d. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2	£16/£16 10s. ton c.i.f.

would be feasible to ship oxide to New Zealand for processing to metal.

Concurrently with the delineation of the Weipa bauxite occurrences, the problem of power is under consideration, with the possibilities of hydro-electric power in New Guinea, coal-generated power at the Blair Athol field, Queensland, and now a suggestion of the use of New Zealand's water power.

CUBAN INTEREST IN NICARO

The General Services Administration in Washington has announced that the Cuban Government has expressed an interest in purchasing the U.S. Government's nickel plant at Nicaro. The plant, which is value at $85,000,000, is located in Oriente province, about 460 miles east of Havana. It was anounced on September 15 that the plant was to be sold, bids being invited up to the close of business on December 1. At the end of September Dr. Fidel Castro, the Cuban Prime Minister, said his government would investigate concessions held by the Moa Bay Mining Co. and the Nicaro nickel plant. An article of specific interest in light of this announcement appears on page 602 of this issue.

NEW DIAMOND DISTRIBUTORS

A report in *The Wall Street Journal* states that Engelhard Industries, Inc. has formed a division to import, process and distribute natural industrial diamonds in the U.S. and provide technical research into their use. The company will crush and grade diamonds into abrasive grit. It will buy natural diamonds from De Beers, but has no plans to distribute synthetic diamonds.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

The copper and tin markets have provided the most interesting features this week and in both cases there have been outside developments which have brought their influence to bear on the course of prices. Lead and zinc have been uneventful and here the general price structure and overall picture shows little change.

COPPER PRICES RISE

Copper values in London have made further headway with the main emphasis on the nearby position, which has resulted in the backwardation widening substantially. A pointer to the present position as regards copper for early delivery may be seen in the fact that this has occurred in spite of very considerable sales of cash and nearby metal which have been well absorbed by the market.

The upward trend was initiated as soon as it became apparent that agreement was likely to be reached which would remove the threat of a dock strike at U.S. Atlantic coast ports. The settlement originated in New York but has met opposition in other Atlantic ports where shippers have withheld their agreement to the terms. But the general picture was regarded in a sufficiently favourable light by U.S. buyers who, having hitherto confined their purchases to material guaranteed for arrival before mid-December, turned their attention to early January arrival. This still represents December delivery f.o.b. shipping port and, with free supplies restricted, only a limited volume of business has been booked.

The other factor affecting the nearby position in London has been a further decline in stocks in U.K. official warehouses of 805 tons to 5,897 tons. Indications point to this tendency continuing, at any rate in the coming week or two, in which case it would be no surprise to see the premium on cash metal further enhanced.

U.S. copper futures on the Commodity Exchange have been firm and active with the main background factor the apparently little progress being made in the strike negotiations. These have now been in progress some four months, causing domestic mines a loss of output of about 250,000 tons. In one respect the strike situation might be said to have worsened in that it seemed likely earlier in the week that Kennecott, the largest producer, was likely to reach agreement. Subsequently, however, the union concerned, Mine, Mill and Smelter Workers, asked for Federal mediation assistance to resolve the impasse. No meetings are scheduled at present between the unions and Phelps Dodge and Anaconda, whilst local difficulties at the Tacoma copper refinery of the American Smelting and Refining Co. were holding up the near settlement.

Belgian copper moved higher during the week and is currently quoted at B.frs. 34 per kilo against B.frs. 33.25 previously.

A BIG RISE IN TIN QUOTAS

The meeting of the International Tin Council in London closed at the end of last week and a communiqué announced that the total permissible exports for the first quarter of 1960 would be increased 6,000 tons over the current quarter to 36,000 tons. The trade generally had expected that this figure would be revised in an upward direction, but the agreed tonnage was somewhat greater than most people had anticipated and may prove to be more than sufficient to offset the current deficit in production against consumption.

On the other hand, future developments in the U.S. Steel Industry after the 80-day "cooling off" period ends next month will be a major factor, together with the ability of certain producing countries to raise their production sufficiently to make the extra supplies available within the first three months of 1960. The communiqué also announced the extension of the Buffer Stock Manager's authority to operate within the price range of £780/830 up to the end of March, 1960, and it was further disclosed that at June 30, the amount of tin held by the Buffer Stock totalled 13,990 tons. The chairman of the Tin Council has since further stated at a Press conference that the Buffer Stock would not be holding less than 10,000 tons by the end of this year. The next council meeting is scheduled for March 8, 1960. Meanwhile, a technical committee of the Council has been meeting in London this week to draw up a final draft of a new tin agreement to be submitted to a U.N. conference next May. The existing agreement ends on June 30, 1961.

The initial impact on the London market was, as to be expected, downward, but values quickly recovered following stronger U.S. demand. Supplies of nearby tin are not plentiful and the backwardation has been maintained following a further decline of stocks in official warehouses of 208 tons to 7,977 tons. Tin consumption in the U.S. was almost unchanged for September, 1959 at 4,825 tons against 4,760 tons for August.

The Eastern price has also recovered from the low level reached earlier in the week and on Thursday was equivalent to £795¼ per ton c.i.f. Europe.

CAN LEAD HOLD 13 c.?

Lead has been an uneventful market with prices showing little change. A small contango has been maintained which appears to indicate that arrivals of foreign metal were on a reduced scale. Reports from the U.S. raised the question as to whether the producers will be able to maintain the domestic price at 13 c. as consumer buying is currently on a much reduced scale and stocks remain substantial.

Total pig lead production in O.E.E.C. countries in October amounted to 54,624 tonnes against 53,613 tonnes in September, whilst zinc figures also showed a small increase at 71,798 tonnes compared with 70,789 tonnes.

ZINC "BACK" WIDENS

Zinc has maintained a very steady tone with once again the shortage in nearby material showing up in a widening of the backwardation as the current dealing period progresses. Generally speaking, there has been no change and the overall picture and outside demand continues at a satisfactory level. U.S. production for November at 62,346 tons shows a slight decline against the October figure of 63,938 tons and stocks at the end of the month were also lower at 176,157 tons compared with 191,251 tons a month earlier.

Closing prices are as follows:

	Dec. 3		Dec. 10	
	Buyers	*Sellers*	*Buyers*	*Sellers*
COPPER				
Cash	£250	£251	£257½	£258
Three months	£238½	£238¾	£241	£241½
Settlement	£251		£258	
Week's turnover	8,200 tons		11,800 tons	
LEAD				
Current ½ month	£71½	£71½	£71½	£71½
Three months	£71¼	£71⅜	£71½	£71¼
Week's turnover	6,275 tons		5,475 tons	
TIN				
Cash	£791	£791½	£792½	£793
Three months	£788	£789	£789½	£790
Settlement	£791½		£793	
Week's turnover	560 tons		415 tons	
ZINC				
Current ½ month	£94½	£94½	£96½	£97
Three months	£89½	£89½	£90½	£90⅝
Week's turnover	6,425 tons		5,125 tons	

A Century of Metal Broking

To commemorate and to record one hundred years of its existence the London metal broking firm of Vivian, Younger and Bond Ltd. has published a book entitled "A Century of Metal Broking"* by Godfrey Harrison. It traces the history of this firm from its inception in 1859 and its relationship with the British Metal Corporation Ltd. and Consolidated Tin Smelters Ltd., showing, at the same time, why such firms as Vivian Younger and Bond came into being and why subsequently they formed the London Metal Exchange. The importance of free market dealings as the regulator of price and supply (exemplified by the London Metal Exchange) is well illustrated in this book by reference to various failures of price or production control in the past 60 or 70 years.

The firm of Vivian and Younger (later to be joined by F. W. Bond) was founded at a time when British capital and "know-how" were developing mines overseas and shipments of imported ores were beginning to be handled on the smelters' behalf by shippers both in Swansea and Liverpool, creating problems of price, assay, terms of payment, etc. This subsequently led to the growth of a market in London for the sale of finished metals, especially copper, lead and zinc and tin, the metal on which V.Y.B's present reputation is chiefly founded. Dealings were in actual metal and the afternoon meetings of the dealers, held in a corner of the Royal Exchange, were the beginnings of the metal market of today. Business was also being done by the firm in Paris as early as 1864.

By the 1870s, there were a hundred copper smelters in Chile and there were also a growing number in Australia and America. Bar copper from these countries came through London to find markets in Britain, Europe and the East and, following increased trade in copper and tin, the London Metal Exchange Company was formed in 1877 with F. W. Bond a member of the first committee and board of directors.

Around 1882, the United States took the lead in copper production and American smelters were pioneering technical developments. At this period, Vivian Younger and Bond's mainstay had been the silver-bearing lead of Broken Hill, which was now running out, but, through the influence of Cecil Budd, who was taking the place of F. W. Bond in the company's affairs, an interest of about one-sixth was obtained in the Australian Metal Co. formed to exploit the Broken Hill property by German methods. Cecil Budd later became chairman of the board of the London Metal Exchange from 1902 to 1929 and was a principal architect of the exchange's fortunes. He also played a prominent part in buying non-ferrous metals for Britain and France during the First World War.

In November 1918, The British Metal Corporation Ltd. was formed in London with Sir Cecil Budd as its first managing director, to help foster the production and trade in non-ferrous metals in the U.K. and Commonwealth generally and in North and South America and to maintain the position of the London Metal Exchange.

V.Y.B. transferred their Australian business to the B.M.C. on the latter's inception, and, four years later, while retaining their separate identity, became part of that group and, to all intents and purposes, its chief agency for the handling of tin. Soon after, the whole capital of V.Y.B., £150,000, was taken up by The British Metal Corporation. Besides B.M.C.'s main activities in the distribution of non-ferrous metals, ores and concentrates, the Corporation was closely connected with mining and exploration, smelting, engineering, insurance and banking concerns.

The difficulties encountered during the years following the First World War, combined with overproduction, caused tin to become a victim to the recession which began in the U.S.A. in 1929. These conditions led to the formation, in December 1929, of the Consolidated Tin Smelters Ltd., to consolidate four tin smelting firms, in two of which Sir Cecil Budd had played a leading part, prior to reorganizing productive capacity which involved closing down Cornish smelters. On July 1, 1930, Consolidated Tin Smelters, took over from the B.M.C. a half share in V.Y.B. with whom they made a sole agency agreement for the sale of their products.

Incidentally, with the coagulation of industry and commerce into larger units such as the Consolidated Tin Smelters there was a tendency to increase direct dealings between seller and buyer and for the big producing groups to set up their own selling agencies (e.g. Copper Exporters Inc.).

During the Second World War the B.M.C. contributed largely to the staffing of the Non-ferrous Metals Control at Rugby. Meanwhile, the London Metal Exchange still kept itself in being and prepared quietly for the day when it would again re-open for business. The Chairmen of the L.M.E. Committee during this difficult period were J. D. Wolff of Rudolf Wolf and Co. and P. W. Smith, of Bassett Smith & Co., whose son has been chairman of the Committee since 1954.

In December 1945, the B.M.C., V.Y.B. and Consolidated Tin Smelters suffered a grievous loss through the death of Sir Cecil Budd. For the next year or two after the war until the London Metal Exchange re-opened for dealing in tin, V.Y.B.'s business retained its war-time pattern. The company succeeded in getting an even greater proportion of the tin available for export. Consolidated Tin Smelters sustained little war damage. When tin was decontrolled in November 1949, V.Y.B. were able to take up their selling agency for both Consolidated Tin's smelters as before.

Meanwhile, in 1946, the company had acquired an interest in the Dutch concern Montaan Metaalhandel and had also bought, after his death, Sir Cecil Budd's share in the insurance firm of Tennant and Budd Ltd. With the acquisition in 1945 of Rolls & Son, itself an old-established firm and a member of the London Commodity Exchange, V.Y.B. also entered the produce and other merchandizing and trading industries, notably in Nigeria. Later, in 1955, they were to withdraw in Nigeria from produce and general merchandizing because of the conditions then prevailing, confining their activities on the trading side almost entirely to building materials, machinery, plant and equipment.

In 1956, by a friendly arrangement, Consolidated Tin Smelters parted with the half share in Vivian, Younger and Bond they had held for 25 years and V.Y.B. once more became a wholly-owned subsidiary of The British Metal Corporation. At the same time the smelting company renewed its agency arrangement with V.Y.B. for a long term of years. In 1950, V.Y.B. had also been appointed sole agents for the tin products of Capper Pass & Son Ltd. of Bristol in all countries except the U.S.A., Canada and Mexico, while the link with Europe through Montaan Metaalhandel was maintained.

Since post-war decontrol, business on the London Metal Exchange has steadily increased and its world standing is higher than ever. Over the past three-quarters of a century various efforts have been made to regulate metal supplies and dealings by price or production control of one kind or another, but many of them, in the end, have failed.

The world has a need for the L.M.E. as the only consistently effective means of equating supply and demand. Notable among the 27 concerns currently dealing in the Ring, Vivian Younger and Bond have played an important part in developing and maintaining its high reputation.

**This book is obtainable only from the publishers, Vivian, Younger and Bond Ltd., Princes House, 95, Gresham Street, London, E.C.2, price 21s.*

SOUTH AFRICAN GOLD AND URANIUM PRODUCERS

Comparison and analysis of results for the first nine months of 1959 and 1958

Heading		*Jan. to Sept.*	*Rand Cos.*	*Klerksdorp Cos.*	*O.F.S. Cos.*	*Total*
Tons milled :	Millions	1959	37·8	5·5	9·5	52·8
		1958	36·5	4·8	7·7	49·0
Ounces produced :	Millions	1959	8·3	2·2	4·1	14·6
		1958	8·0	1·9	3·2	13·1
Grade per ton :	Dwt.	1959	4·4	8·0	8·6	5·5
		1958	4·2	7·8	8·2	5·2
Working costs per ton :	s. d.	1959	39/10	57/7	59/7	45/2
		1958	42/10	54/6	59/8	46/7
Working profits :	Gold £m.	1959	28·4	11·9	22·7	63·0
		1958	18·1	10·4	16·6	45·1
Working profits :	Uranium and Acid £m.	1959	7·5	8·6	5·4	21·5
		1958	15·8	7·5	4·7	28·0
	Total £m.	1959	35·9	20·5	28·1	84·5
		1958	33·9	17·9	21·3	73·1
Dividends declared :	£m.	1959	8·5	5·5	16·7	30·7
		1958	9·1	5·0	13·3	27·4
Non-Europeans at end September :		1959	243,000	51,000	78,000	372,000
		1958	231,000	39,000	64,000	334,000
Number of Cos. included :		1959	38	7	10	55
		1958	37	7	10	54

Footnote :
When comparing the Working costs and Working profit figures, it should be noted that from 1/1/1959 Uranium mining and milling costs are no longer included under the heading "Working costs" but are charged against Uranium revenue.

Mining Finance

Problems on South Africa's Blind River

By coincidence, it happens that the reports and accounts have recently been published of most of the companies interested in South Africa's " Blind River ", that area to the north of the Klerksdorp area where some extremely high uranium values have been developed in recent years. This, therefore, is a good time to look at their prospects in the light of recent developments in the uranium situation.

The companies in this area are all uranium producers first and foremost ; any gold which may be produced is strictly a by-product, although in several cases the mine was originally brought into being as a gold operation. This being so, the effect of the imposition of sales quotas has been even more strongly marked on these companies than on the by-product uranium producers of the major South African fields. At Dominion Reefs, for example, the mining programme has been readjusted so that the exhaustion of its ore dumps will co-incide with the expiry of its sales contract. Underground mining will only be carried out to the extent to which the quota is unfulfilled.

The position at Klerksdorp Consolidated is even more depressing. This company has been trying for some years to obtain permission to produce uranium, but to no avail, and the introduction of quotas earlier this year appeared to mark the end of any such plans. Nothing if not a tryer, however, the company allowed its mine to flood, but not before sending samples of its ore to testing laboratories in Canada and Germany. The Canadian tests have shown that it should be possible to treat Klerksdorp's ore by a process involving less capital outlay than the usual plant. An amended application has been made to the authorities, but, says the chairman, the official attitude is sympathetic but not optimistic. Meanwhile, Klerksdorp Consolidated has taken an interest in Wandrag Asbestos, which has recently opened a plant in Cape Province. The proposition, says Mr. Williams, is of decided promise.

Perhaps the best placed company is Afrikander Lease. Quota restrictions have, indeed, impinged on this company, as on the others, and to counteract this to some extent, production is being continued at the Old Afrikander Section, where appreciable quantities of gold are associated with the uranium. (Dominion Reefs, too, is stepping up its gold output.) Nevertheless, Afrikander has been lucky enough to be granted an additional quota of 60,000 lb. per annum while Ellaton is still in business, roughly equivalent to Ellaton's shortfall, and a further 64,000 lb. per annum thereafter. Eventually, therefore, Afrikander's quota will be 242,000 lb. per annum, against the original 117,800 lb.

The increased quota is subject to payment of royalties and amortisation contributions. Indeed, in financial terms, Afrikander will make very little extra profit out of the additional quota, but because the quota can largely be met from the Old Afrikander section, the rich ore in the Rietkuil Section (last year : 153.9 in./lb.) can be conserved until the expiry of the sales contract. From an investment point of view, therefore, Afrikander is the best buy among the producing mines.

TANKS CENTRAL AND CENTRAL SALLIES

Mention of Afrikander, however, leads to the holding companies which together hold almost 85 per cent of Afrikander's equity. The companies concerned are Tanganyika Central Gold Mines and Central South African Lands and Mines, and the important thing about them is that although the Afrikander holding forms the largest single item in each of the balance sheets, both companies have other interesting aspects to their operations.

Tanks Central, for example, has acquired an interest in two prospecting contracts that are in progress in areas in the Ventersdorp and Lichtenburg districts. In addition, it has a holding of land in the O.F.S. which may eventually be turned to account. In the meantime, Tanks Central has announced plans for the writing-off of 6d. from each 1s. share. This will be set off against the accumulated loss of £105,000, paving the way for dividends when profits warrant.

The Central Sallies position is more interesting still. Like Tanks Central, Central Sallies has an interest in land in the Ventersdorp area, which is currently the centre of intensive prospecting. This interest is held via a 21 per cent holding of North Vaal Mineral Company, which owns mineral rights over some 925,000 acres of the Transvaal, and several new prospecting contracts have been granted during the year. Additionally, Central Sallies has a wholly-owned subsidiary, S.A. Dry Cleaners, which made a loss last year, but which must have good prospects for the future.

THE URANIUM STRETCH

The first semi-official admission that South African uranium contracts may be stretched in the same way as those in Canada was made by Mr. P. H. Anderson, chairman of Harmony, at that company's annual meeting in Johannesburg.

Mr. Anderson said that the interests of shareholders would be fully considered in connection with any such action. He went on to say that the matter was under discussion, but it is not clear whether he was referring to discussions at board level on shareholders' interests, or to C.D.A./Chamber of Mines discussions on the lengthening of contracts. If, indeed, Mr. Anderson meant the latter, this would confirm talk to this effect which has been in circulation for some weeks, and was referred to in last month's *Quarterly Supplement*.

Other points from answers to shareholders' questions were : The main haulages being driven westward from No. 2 shaft on 25 level have not yet intersected reef, but underground borehole results from these twin-haulages were encouraging. Boxholes are now being put up and raising back to No. 2 shaft would commence shortly.

Taking an arbitrary line of demarcation between the Nos. 3 and 2 shaft areas, about 25 per cent of tonnage stoped during the last financial year came from the No. 2 shaft area. During the current financial year, about 33 per cent would come from this area, and the proportion from the vicinity of No. 2 shaft would gradually increase.

The re-assessment of the capital expenditure programme shows only a small increase in expenditure, but there is a change in timing. Previously it was estimated that £6,000,000 would be spent on capital account during the 2 years ended June 30, whereas the new programme provides for £6,500,000 to be spent in the three years to June 30, 1961.

The fourth unit of the gold reduction plant, bringing it to a rated capacity of 200,000 tons per month, is nearly completed. Every effort is being made to build up tonnage from underground, but this depends on the provision of sufficient stope faces and the provision of other necessary facilities.

MORE FISH IN THE SEA

Before the Rand goldfield was discovered, gold mining was financially the riskiest of operations. The orebodies in other mining fields were capricious and erratic, and it was a brave man who invested in them. Modern mining and prospecting methods have, it is true, reduced this risk to a considerable extent, but the fact remains that the gold horizons in the Transvaal and O.F.S. are so consistent in comparison with those elsewhere that, to quote Mr. S. G. Menell, chairman of Anglo-Transvaal, the South African mines have come to be thought of as gold factories rather than gold mines.

Such failures as Merriespruit and Freddies are, fortunately, so rare that they affect the overall picture to a very small degree. Nevertheless, their very rarity makes the casualties stand out in black contrast, and it is easy to over-estimate their importance. It is therefore salutary to remember that out of 19 major mines brought to production since the war, only three can be regarded as failures, and only one, the unlucky Merriespruit, as a complete write-off.

The important thing, however, is that the S.A. gold industry is now well advanced on one of its periodic spurts of expansion. Triggered by surplus liquidity—Anglovaal is typical in having the most liquid balance sheet in its history—and spurred by the approaching demise of several of the old Central and East Rand mines, the greatest prospecting drive in the history of the industry is being pressed ahead. So far, in the seventy years of the Rand's existence, the rate at which new mines have been brought to production has always exceeded the rate of wastage.

There is an analogy here with one of Anglovaal's interests outside mining—its deep-sea fishing fleet. Last year, this fleet landed as much trawled fish as the whole of the South African fishing industry ten years before, truly concrete evidence that " there are more fish in the sea than ever came out of it ". Nowhere is this proving to be more true than on the Rand.

Mr. Menell's speech, which contains pertinent comments on the gold price question and on the future for gold shares, appears on page 613.

MOTAPA TO WIND UP

A circular from Motapa Gold Mining states that the final clean-up in the reduction plant was completed towards the end of September, and that the mine has now been completely shut down. Underground equipment has been reclaimed, and the number of employees reduced to the minimum necessary for the protection of

dangerous workings and the safeguarding of buildings, plant and equipment.

Obviously, the amount of liquidation distributions available to shareholders will depend on such factors as the market for second-hand plant, and at present it is impossible to put any estimate on the value of the shares as a break-up proposition. All that can be said is that at the date of the last balance sheet, net current assets amounted to about £80,000, but this may well have been further reduced by the running down of stores and materials.

As far as the second-hand plant market is concerned, Motapa's end may prove to have come at an opportune time. Through various offers and acquisitions, Rio Tinto has lately been interesting itself in the S. Rhodesian gold industry, and with any luck, several prospects may in due course be brought to production and small operations expanded. It is not inconceivable, therefore, that the availability of Motapa's plant at this time could be advantageous both to Rio Tinto and to Motapa.

Certainly Motapa's shareholders, who have not seen a dividend since the flotation of the company by Gold Fields Rhodesian in 1947, deserve some luck.

Motapa are currently priced at about 1s. This puts the saleable value of the plant and other assets at about £160,000. Only time will tell whether or not this is realistic.

MORE KAFFIR DIVIDENDS

This week's batch of Kaffir dividends comes from the Gold Fields and General Mining groups. Most payments were as expected or forecast, but there were two surprises, one good, the other not so good.

The pleasant surprise was the raising of the West Driefontein dividend to 4s. 9d., compared with 4s. 3d. in June. An improvement to 4s. 6d. had been widely expected, because for some time dividends from this West Wits producer had been rising by 3d. each half-year.

It was Stilfontein that provided the disappointment. From 1s. 10½d. paid in each of the four preceding half-years, the dividend is reduced to 1s. 7½d. This is probably attributable partly to heavy capital spending and partly to the approaching onset of taxation.

The latest dividends are summarized below, together with the three preceding payments for comparison.

Mine	*June* 1958	*Dec.* 1958	*June* 1959	*Dec.* 1959
	s. d.	s. d.	s. d.	s. d.
General Mining				
Buffels.. ..	1 6	1 6	1 6	1 9
S. Roodepoort	1 1½	1 1½	1 1½	1 1½
Stilfontein ..	1 10½	1 10½	1 10½	1 7½
W. Rand Cons.	2 0	2 3	2 0	2 3
Gold Fields				
Doornfontein	1 0	1 6	1 6	1 6
Libanon ..	3½	3½	3½	3½
Luipaards V. ..	1 1	1 0	1 0	1 0
Venterspost ..	10½	10½	10½	10½
Vlakfontein ..	11	1 0	11	1 0
West Drie ..	3 9	4 0	4 3	4 9

Capital repayments announced simultaneously with these dividends are : Rietfontein (8d.), Sub Nigel (1s. 3d.), and Vogels (10d.). No capital repayments were announced for Robinson Deep and Simmer and Jack.

FINANCE COMPANY PAYMENTS

Some of the finance companies associated with the above mines have also made dividend announcements. West Wits has raised its distribution from 1s. 9d. to 1s. 10½d. largely, it must be assumed, as a result of the accelerated rate of improvement in the West Drie. payments.

Two of the General Mining companies interested in the Klerksdorp area, East Rand Extensions and Southern Van Ryn, are both repeating an established pattern. S. Van Ryn is paying 7d. per share, as last year, while E.R.X. is paying 1s. to make an unchanged 1s. 9d. for 1959.

A third General Mining holding company, New Pioneer, has declared its first interim. This will be in the amount of 1s. 3d. per share, and compares with a single payment of 2s. 9d. for the 1958-9 financial year. New Pioneer holds shares of the Lucas block mines, together with important land holdings and real estate interests.

NEW EXPOSURE AT N. BROKEN HILL

An interesting feature of the North Broken Hill Company's year is that the southern orebody has been exposed over 300 ft. wide at the 3,520 ft. level. On the dimensions estimated, the tonnage per vertical foot would be as great, if not greater than at any other level, according to the address by the chairman at the annual meeting. Mining profit showed an increase from a loss of £A96,398 in 1957-58 to £A516,615, in the year ended June 30, 1959. Average basic wage for year at £14 5s. 1d., compared with the previous £14 2s. 2d., and the lead bonus averaged £8 18s. 9d., compared with £10 9s. 7d. Ore reserves are estimated at 4,344,000 tons, the estimate in the previous year being 4,588,000 tons.

MOUNT MORGAN PLANS OUTLET

At the annual meeting of Mount Morgan, Mr. J. Malcolm Newman said that in the 30 years since the present company was formed, 55,000,000 tons of material had been mined by the open cut method, of which 19,000,000 tons was ore for the mills and smelter. Metal recoveries in the period were 109,000 tons of copper ; 1,423,000 oz. of gold and 479,000 oz. of silver. Residues amounting to 18,000,000 tons are stored against retreatment for their iron and sulphur contents. The policy of the Commonwealth Government in withdrawing encouragement to acid manufacturers to use local sulphide ores and concentrates instead of imported sulphur, an encouragement which had been an important factor in Mt. Morgan's policy, was a severe blow to the company. The withdrawal was in opposition to the recommendation of the Tariff Board.

Mount Morgan has now planned an ammonium sulphate industry, which will require 50,000 tons of pyrite concentrate per year. The company will be joined in this project by the U.S. firm of W. R. Grace and Co. provided the examination by its experts is satisfactory. The chairman stated that his previous view that the future can be looked to with a measure of assurance of fair profits, with anticipation of better times ahead, has been confirmed by the year's results. Provided the stabilized Australian copper price is maintained to assist excess overburden removal, Mt. Morgan should continue to be a fair profit earner.

LONDON MARKET HIGHLIGHTS

A generally firm tone persisted in the South African gold share market during the past week, but once again the turnover stayed rather modest.

Demand was again mostly from the Cape. West Wits. (84s.), " Writs " (69s. 9d.) and West Driefontein (193s. 9d.) were singled out from time to time. The last named fulfilled earlier hopes of a good December dividend by raising its payment for the half-year by 6d. to 4s. 9d.

Buffelsfontein (48s.) also benefited from a higher dividend. Stilfontein declared a lower payment but the share price actually hardened to 38s. following the news ; the explanation for this was in some bear-closing operations at the Cape.

U.S. demand seemed to be centred largely on Libanon at 16s. and Durban Deep at 39s. 6d. As far as London was concerned interest was stimulated by the unusual occurrence of two brokers' circulars within seven days. Buyers came in for Free State Geduld (193s. 1½d.) and Western Holdings (163s. 1½d.) but they were deterred for a while in Gold Fields (96s.) when they heard of the company's share placing arrangement with the " Old Mutual ".

Tin shares opened with a fresh burst of strength following the week-end news of sharply increased export quotas for the first quarter of 1960. Producers will be able to export 36,000 tons in that period, not far short of the 38,350 tons that was the quarterly production rate before tin restriction started.

The rise in the tin share market was tempered to some extent by the Tin Council disclosure that there would be 10,000 tons in the buffer stock by the end of the year, a statement that surprised nearly everybody until it was learned that the manager could buy as well as sell in the £780 - £830 a ton range.

Even so, Tronoh — mentioned here only a fortnight ago as looking attractive at 28s. 6d. — advanced to 32s. 6d., while among many other good gains Ayer Hitam climbed to a new peak of 61s. Pahang at 10s. were double the price of eight months ago.

With the copper price hovering around the £260 a ton level it was not surprising that there should also be a selective demand for copper shares. Messina were one of the first to attract investment attention and advanced from 122s. 6d. to 130s. in three days.

Nchanga rose steadily to 73s. 9d.; with almost nine months of the company's financial year past it was generally expected that the interim dividend due next week would reflect the high metal price during that period. Talk that Chartered were to have a Johannesburg listing was duly confirmed and the first quotation was made there on Wednesday. Little business was attracted though ; in London the share eased slightly to 110s. 9d. on that day. Among other coppers, Selection Trust were a consistently good market at 126s. 10½d.

Elsewhere, Uruwira Minerals fell 2½d. to 3d. before rallying to 4½d. following the chairman's reference to the company's difficult financial and operational outlook. Henderson's (14s.) were not helped by the announcement of their proposed colliery take-over.

ANGLO-TRANSVAAL CONSOLIDATED INVESTMENT COMPANY, LIMITED

CHAIRMAN'S REVIEW

VIGOROUS WIDESPREAD PROSPECTING BACKED BY RECORD LIQUID RESOURCES

VAST DEVELOPMENT OF FISHING INDUSTRY

GOLD MINES SOUND INVESTMENT DESPITE OCCASIONAL DISAPPOINTMENTS

The 26th Annual General Meeting of the Anglo-Transvaal Consolidated Investment Company, Limited, was held in Johannesburg on Friday, December 4, 1959.

Mr. S. G. Menell, the Chairman of the Company, presided, and in the course of his address to members said:—

I have pleasure in presenting for your approval the 26th Annual Directors' Report and Accounts for the year ended June 30, 1959.

The Accounts before you reflect a net profit of £961,000, which is an increase of £17,000 on last year's figure. A surplus of £314,000 arising from the sale of certain shares to the American-South African Investment Company, Limited is shown separately. From the aggregate profit of £1,275,000 we have provided £169,000 for taxation, depreciation of investments, and exploratory expenditure, and £300,000 has been placed to General Reserve. This leaves a balance of £806,000, to which must be added last year's carry-forward of £394,000, making £1.2 million available for appropriation.

The dividend on the Ordinary and "A" Ordinary shares was increased from 50 per cent. to 60 per cent., and, in addition, an amount of £175,000 standing to the credit of the Profit and Loss Account was distributed by way of a bonus in the form of Participating Preference Shares. These appropriations, together with the payment of the usual preference dividends, &c., left a balance unappropriated of £392,000 to be carried forward to the current year.

The Balance Sheet discloses an excess of assets over liabilities of approximately £7 million. This figure, however, does not include the surplus of £4.5 million by which the market value of quoted investments exceeds the book value at June 30, 1959. With the Revenue Reserves now standing at £4.2 million, and taking into consideration the additional amount of £1.6 million, being the Company's proportion of the undistributed net profits (after providing for taxation) of the subsidiary companies of the Group, the Balance Sheet reflects a sound position.

Strong Cash Position

Our strong cash position places the Company in a more liquid position than ever before in its history. There has also been a further increase in our permanent sources of income from dividends and other recurring items which has been a significant feature of our operations during the last few years. The summary of our various interests, which is incorporated in the Report and Accounts before you, will bring you up-to-date in regard to the operations of the various Group companies. There are a few features, however, that I would like to deal with at this meeting.

During the year under review we formed a wholly owned subsidiary, the Anglo-Transvaal Finance Corporation (Pty) Limited, as the medium for handling funds for investment, and also the Group insurance business.

Potential Nickel Mine

The Group continues its vigorous policy of prospecting for minerals, which is conducted mainly through Middle Wits. We have been active in prospecting operations and drilling programmes in the Transvaal, Orange Free State, and the Rhodesias. Our work in Southern Rhodesia has recently established an attractive Nickel prospect which holds out promise of developing into a producing mine.

The recent arrangements for the merger of Middle Wits. and Rooderand serve to concentrate our Group exploration activities in Middle Wits. These two Companies had complementary interests, and the terms of the merger were considered to be in the best interests of the shareholders of both Companies.

Fishing Industry Expansion

The industrial interests of the Group have enjoyed a year of comparative prosperity, during a time when the general industrial activity of the country tended to slacken.

Amongst Anglo-Transvaal Industries' activities, an outstanding year's operation was achieved by their subsidary, The South Atlantic Corporation, which has deep sea trawling and major engineering interests. Since your Group entered the fishing industry approximately ten years ago, it has been responsible for doubling the catch of trawled fish. This development has led to the establishment of large modern processing factories, which besides catering for the Union's requirements have increased the exports of their products from £400,000 in 1950 to over £2,300,000 this year.

Ferro-Manganese Early Success

The Feralloys Ltd. plant at Cato Ridge recently made an auspicious start with the production of high carbon ferro-manganese of excellent quality. One of the factors which has materially contributed to the success of this project in the relatively short space of time since its inception in 1957, has been the circumstance of being able to mine a better grade of ore—and at a lower mining cost.

This resulted in the production of ferro-manganese containing a high manganese content and an unusually low content of deleterious impurities at a cost which should enable the Company to operate on a very profitable basis, even at the present low world price for ferro-manganese.

The proposed merger of Feralloys and Associated Manganese will place the latter Company in a strong position with regard to the sales of its minerals either as raw materials or as semi-processed metals in the form of ferro-manganese, and possibly eventually, in addition also pig iron.

Group Research Successes

Within the Group we maintain a central laboratory which not only handles routine analyses and investigations, but also carries out applied existing operations and potential new research in respect of our various ventures. In particular it is concerned with problems of ore dressing and with the improved recovery of metals from their ores. In this direction the Anglovaal Laboratory has achieved some notable successes, particularly in improving processes used for the recovery of gold and uranium.

At the Hartebeestfontein mine, for example, an improved process known as the "Reverse Leach" was developed in the laboratory and then applied at the mine. The pulp from the mill is treated first for the recovery of uranium and then for the recovery of gold. The yield of both uranium and gold has been increased.

At Virginia, where conditions are different, the "Hot Ferric Leach" process was evolved at the laboratory for improving the extraction of uranium from the type of ore at that mine. This process is now in operation at the Virginia mine, and has resulted in an improvement in the uranium recovery.

These processes have resulted in increasing the profits of each of the Hartebeestfontein and Virginia mines by some £150,000 to £200,000 per annum.

One more recent success has been a process for the economic concentration of nickel found at the newly discovered deposit located in Southern Rhodesia.

Overall Soundness of Gold Share Investments

The problems at the Merriespruit Mine have no doubt been a shock to shareholders and investors who have come to regard a gold mining lease area as an investment in which the amount of money expended to bring a mine to production is rarely in jeopardy.

Indeed, the main underlying incentive for undertaking gold mining activities on the principal South African goldfields and for continuing the search for extensions of these, has been the unique nature of the stratified goldbearing conglomerates of the Witwatersrand system. These, for some 70 years, have supported large-scale mining operations, first on the Witwatersrand, then on the Far East Rand, on the Far West Rand, in the Klerksdorp area, and, latterly, in the Orange Free State and the Bethal area.

Although the percentage payability of the principal gold-carrying horizons varies from district to district, and also, frequently, from mine to mine, these conglomerates on the whole, from the earliest times, were recognized as being persistent and reliable gold carriers over wide areas.

In this important respect, they differ radically in character and in reliability from the other types of auriferous igneous ore-bodies which, before the opening up of the Witwatersrand, constituted the main source of the world's gold supply. Because of the capricious nature of the gold distribution in these other occurrences, gold mining investments carried with them the stigma of being of a highly speculative class. With the opening up of the vast South African goldfields based on the exploitation of the gold-bearing conglomerates, however, a major stable industry, now of

long standing and with a substantial future still ahead, came into being.

The predictability of operations, and the conditions lending themselves to forward planning with precision, were early proved to be of such an order as to have led the large South African gold mines to come to be regarded as gold factories rather than as gold mines, viewed in the speculative sense.

The progress made by the South African gold mining industry and its expansion to the present magnitude can be gauged from the following summarized statistical information.

The Witwatersrand was proclaimed as a goldfield in 1886. Dividends distributed between 1892 and 1896 reached an average of £1½ million per annum. In 1958, 54 producing gold mines, of which 22, in addition produce uranium oxide as a by-product, crushed over 65 million tons at an average recovery grade of 5.2 dwts., and distributed over £42 million in dividends, equivalent to approximately 13/- per ton milled.

Significant also in South Africa's contribution to the world's gold output is the fact that in 1887 South Africa contributed under 1 per cent of the total world's gold output, whereas in 1958 this figure was over 58 per cent., excluding Russia.

The dollar price of gold which was fixed in 1934 at 35 dollars an ounce and has remained pegged at that level ever since, is unrealistically low not only in relation to world monetary requirements but also in relation to the economics of gold mining in South Africa.

The cost of bringing a large gold mine to production during the period 1934/39 was between three and four million pounds. The average expenditure to date on similar mines established after the war is between ten and twelve million pounds. The increase in capital cost of some 200% is also reflected in higher working costs as the average cost during the period 1934/39 for mines established in that period was approximately 20/- per ton milled, whereas for the mines established in the post-war era the cost during 1959 has averaged some 60/- per ton milled.

Fortunately many of the new mines, by which I mean those started after the war, contain exceptionally high grade ore and are yielding good rewards to investors. The new mines which have reached production although not yet operating at their planned capacity in most instances are already producing some 50% of South Africa's record rate of gold output and are paying dividends of about £30,000,000 per annum despite large profit retentions for expansion purposes, loan repayments and the like.

The capital employed in these new mines for gold mining purposes, including retained profits, already amounts to some £300,000,000. About £35,000,000 has also been expended on uranium installations on these mines.

That this sound position exists despite the present low gold price is a tribute to the inherent soundness of the gold mining industry in South Africa. At times the industry has gone through difficult periods, particularly on those mines where the gap between the value of the ore milled, at the then prevailing gold prices, and the costs of production became critically narrow. In this respect history is repeating itself and the disappointments experienced by some of the new mines is attributable to this.

Since the inception of our gold mining industry, however, there have been instances of mines on the major South African goldfields having failed to come to production or to continue as separate entities, but these are relatively few in number, and their incidence does not in any significant measure detract from the long history of the overall prosperity of the South African gold mining industry.

Overseas Investors

Largely owing to the exceptional attraction of British Industrial shares, London has not, as yet, resumed the role of being a centre of activity in South African gold shares.

However, there are indications that British investment institutions, which made the City of London the financial centre of the world by following a policy of investing around the globe, are now taking a different viewpoint of the unwarranted reports on South Africa's instability which had been circulating for so long.

As this revival of interest occurs at a time when British industrial shares are enjoying an apparently unprecedented boom, we may expect that when this condition subsides, there will be an accelerated interest in our market, because our system of private enterprise, unchanged for generations, should attract all classes of investors.

Conclusion

In conclusion, I would like to record my appreciation of the assistance I have received from my co-Managing Director, Mr. B. L. Bernstein, and my other colleagues on the Board, and to them and to the staffs in the Head and London Offices of the parent company, and the mines and industries of the Group, I express my thanks for the services they have rendered to the Group during the year under review.

The Report and Accounts for the year ended June 30, 1959, were then adopted, and the retiring Directors, Messrs. B. E. Hersov and C. H. Leon, were re-elected.

The joint Auditors' remuneration for the year was fixed.

NATIONAL MINING CORPORATION

MR. C. J. BURNS'S STATEMENT

The Annual General Meeting of National Mining Corporation, Ltd., was held on December 9 at the Chartered Insurance Institute, London, E.C.

Mr. C. J. Burns, Chairman, presided.

The following is an extract from his Statement circulated with the Report and Accounts for the year to March 31, 1959:—

The accounts for the year under review record a slightly increased profit at £31,732 against £29,081 for the previous year. Quoted Investments with a book value of £203,995 showed an appreciation at the date of the Balance Sheet of £15,312 against a depreciation last year of £12,865.

The Unquoted Investments at £206,750 include interests in Mines Development Syndicate (West Africa) Ltd. of £111,106 and in Alberta Ytong Manufacturing Co. Ltd. of £51,886 making a total of £162,992. These two investments have been a source of concern to your directors and have necessitated the retention of profits which otherwise would have been available for dividends.

The prospects of raising the required working capital for Mines Development Syndicate (West Africa) Ltd. are brighter than for some years past, and the good grade ore reserves would seem to guarantee profitable operations as and when active production commences.

Interim Dividend

As a result of continued improvement in market conditions our quoted investments at present have a market valuation of £273,800 against a book value of £222,900. The Directors have declared an interim dividend for the current year of 5 per cent less income tax which will be payable to members on December 18, 1959.

British Patent Glazing Co. Ltd.

In July of this year the Corporation acquired the whole of the Issued Share Capital of British Patent Glazing Co. Ltd for the sum of £80,500 cash, payable as to £55,500 on acquisition (this has already been paid) and the balance of £25.000 payable over a period of two years without interest. The Company specialises in glass roofing and vertical glazing, and manufactures aluminium bars and lantern lights and is well regarded in this particular trade. The profits of the Company have averaged approximately £25,000 per annum and, while it would be imprudent to disregard competition from larger units in this trade, it is the intention of your Directors to expand the business as opportunity permits. In the meantime, the investment is regarded as highly satisfactory, and likely to be an income producer to the Corporation for several years to come.

I have every confidence that the marked improvement in our affairs will be fully maintained over the next few years.

The Report and Accounts were adopted.

Financial News and Results

Rahman's Year.—Rahman Hydraulic Tin earned a net profit of $M.152,917 in the year to June 30 last, compared with a loss of $M.142,224 in 1957-8. In his review, the chairman, Mr. R. D. Hume, says that the quarry mill section, the highest cost area on the mine, remained closed during the year. The meeting is being held in Penang today.

Griqualand Exploration and Finance.—At £299,446, the group trading profit of Griqualand Exploration and Finance for the year to May 31 last was £22,000 up on the previous year's result. Net attributable profit was £160,845, and a dividend of 2s. (against 1s. 6d.) is recommended. The tonnage of asbestos produced by the group was 10 per cent higher than in 1957-8. Proposals are in hand for an increase in the nominal value of the shares from 4s. to 10s. Meeting, December 30.

New Guinea Goldfields.—Earnings of New Guinea Goldfields in the year to June 30 last amounted to £62,639, compared with £84,654 in the preceding year. A dividend of 3d., to be paid from Gold Mining Profits Reserve, is recommended. As similar distribution was made last year. The meeting was held last week in Sydney.

Beralt's Interim.—Beralt Tin and Wolfram will in future decide on the payment of an interim dividend in March, in order to spread payments over the year more evenly. Announcing this, the company states that it is now receiving benefit from the recovery in the wolfram price.

A.S.A.I.C.'s Quarter.—During the three months ended September 30 last, the value of the American-South African Investment Company's portfolio increased by 1.4 per cent to reach $35.58 per share. Since December 31, 1958, the increase has been equivalent to 18.4 per cent of the value at that time. A dividend of 20 c. per share has been declared payable on December 28.

Rand and Orange Free State Returns for November

GOLD OUTPUT AND PROFIT

Company	November 1959 Tons (000)	Yield (oz.)	Profit† (£000)	Year ends	Current Financial Year Total to date Tons (000)	Yield (oz.)	Profit† (£000)	Last Financial Year Total to date Tons (000)	Yield (oz.)	Profit† (£000)
Gold Fields										
Doornfontein	95	38,641	191·1	J	474	192,463	952·2	438	182,687	964·7
Libanon	114	26,964	67·1	J	553	129,935	310·0	490	115,492	272·7
Luipaards Vlei	70	12,425	5·5	J	360	63,647	28·7	350	60,231	27·1
Rietfontein	16	4,293	8·1	D	176	46,663	83·6	232	53,858	133·5
Robinson	54	10,100	L13·8	D	636	131,812	L85·2	796	168,791	30·2
Simmer & Jack	75	14,879	L6·3	D	932	178,630	L37·9	969	184,764	151·9
Sub Nigel	66	15,431	17·6	J	330	78,585	104·3	331	79,889	127·6
Venterspost	123	31,531	59·7	J	634	159,760	306·6	650	160,528	302·3
Vlakfontein	52	18,594	88·8	D	559	200,640	950·2	546	192,884	934·3
Vogels	90	19,238	24·2	D	1,004	223,946	380·7	1,049	234,255	485·0
West Drie	110	100,667	851·2	J	515	471,275	3949·8	401	382,952	3136·7
Anglo American										
Brakpan	139	17,227	12·2	D	1,529	185,385	126·3	1,362	181,861	130·8
Daggas	230	46,580	225·6	D	2,631	529,496	2587·1	2,555	529,959	2784·1
East Daggas	104	17,543	39·8	D	1,108	185,726	378·5	1,005	166,391	310·6
F. S. Geduld	94	80,501	646·2	S	187	157,930	1250·8	149	109,780	803·1
President Brand	115	94,918	838·6	S	232	191,151	1691·1	194	144,747	1206·8
President Steyn	104	41,189	198·0	S	208	82,477	393·7	189	73,896	390·9
S. A. Lands	94	19,704	52·7	D	1,061	221,800	620·8	988	213,412	587·5
Springs	105	14,458	15·5	D	1,146	157,069	146·0	1,392	158,958	97·0
Vaal Reefs	97	43,651	232·3	D	995	449,088	2374·1	804	363,365	2061·5
Welkom	98	30,961	78·4	S	196	61,910	157·8	180	54,233	156·5
Western Holdings	138	89,798	724·4	S	274	176,138	1411·0	200	115,503	866·8
West. Reefs Ex.	138	37,260	119·8	D	1,448	381,582	1160·6	1,223	292,056	713·5
Central Mining										
Blyvoor	125	83,220	641·1	J	647	424,011	3213·5	520	341,317	2480·2
City Deep	105	22,050	7·0	D	1,256	261,690	102·7	1,398	276,440	117·1
Cons. M. R.	90	16,366	7·2	J	485	90,105	38·7	758	101,950	73·1
Crown	204	33,895	17·2	D	2,419	385,595	154·0	2,531	386,000	170·2
D. Roodepoort	194	35,418	52·5	D	2,110	389,263	588·2	2,015	364,671	565·2
East Rand Prop.	211	55,225	103·4	D	2,422	630,421	1295·0	2,362	621,730	1581·0
Harmony	136	54,403	243·6	J	702	278,359	1258·0	481	192,556	749·7
Modder East	128	12,862	2·0	J	696	67,379	13·4	671	66,426	9·8
Rose Deep	25	4,347	25·2	D	409	57,215	23·4	581	77,343	L17·9
J.C.I.*										
Freddies Cons.	60	14,350	L36·5	D	654	156,936	L406·3	585	164,859	L429·9
Govt. G.M.A.	50	10,521	1·0	D	584	117,731	L10·8	687	123,352	5·6
Randfontein	31	5,632	5·1	D	387	66,611	89·3	294	47,888	55·9
Union Corporation										
East Geduld	133	39,235	263·5	D	1,521	454,693	3063·1	1,417	435,788	2985·6
Geduld Prop.	72	13,500	34·5	D	807	152,225	323·3	857	141,111	131·6
Grootvlei	215	44,939	243·7	D	2,345	494,419	2570·0	2,165	460,638	2345·9
Marievale	94	22,748	115·9	D	1,041	255,249	1260·7	807	210,935	946·3
St. Helena	150	48,376	287·8	D	1,660	509,314	2835·3	1,329	389,249	1990·8
Van Dyk	70	12,879	25·2	D	822	154,340	302·0	839	154,632	275·8
Winkelhaak	69	19,493	53·3	D	829	212,194	501·5	—	—	—
General Mining										
Buffelsfontein	145	55,963	296·0	J	722	275,611	1443·9	599	202,159	926·2
Ellaton	30	6,964	27·0	D	341	79,163	316·1	351	81,648	349·4
S. Roodepoort	29	6,912	22·1	J	150	35,640	114·3	150	35,251	120·5
Stilfontein	160	71,985	400·3	D	1,594	758,855	4489·8	1,274	635,363	4123·6
W. Rand Cons.	132	18,543	11·5	D	1,513	218,478	193·1	1,509	202,532	163·0
Anglo Transvaal										
Hartebeestfontein	104	50,960	316·2	J	476	247,415	1574·5	435	238,380	1592·1
Loraine	80	16,200	L18·4	S	162	32,600	L36·6	148	28,763	L38·4
N. Klerksdorp	10	1,322	L5·2	D	113	12,559	L90·2	111	11,937	L89·0
Rand Leases	190	28,310	27·4	J	970	143,453	143·6	901	130,806	58·8
Village M.R.	32	4,464	0·1	J	250	23,410	4·7	136	23,545	2·5
Virginia O.F.S.	136	30,940	20·8	J	668	153,637	73·9	551	144,508	227·6
Others										
N. Kleinfontein	82	10,495	3·0	D	910	118,056	34·0	954	117,558	L22·1
Wit. Nigel	19	4,385	5·3	J	82	21,910	26·0	89	21,498	31·2

Gold has been valued at 249s. 7d. per oz. fine. (October 249s. 6d.). L indicates loss. † Working Profit. * Working Profit includes sundry revenue. Table excludes profits from Uranium, Pyrite and Acid, and also production from Uranium divisions at Luipaards Vlei, Randfontein and W. Rand Consolidated.

ESTIMATED URANIUM REVENUE

Company	Year ends	Nov. Profit (£000)	This year (cum.) (£000)	Last year (cum.) (£000)	Company	Year ends	Nov. Profit (£000)	This year (cum.) (£000)	Last year (cum.) (£000)
Gold Fields					**J.C.I.**				
Doornfontein	J	15·0	73·0	75·0	E. Champ d'Or (*b*)	D	7·2*	75·6*	66·7*
Luipaards Vlei (*a*)	J	94·0	467·0	448·0	Freddies Cons.	D	36·0*	388·0*	313·0*
Vogels	D	54·0	579·0	584·0	Govt. G.M.A.	D	23·0*	244·7*	269·3*
West Drie	J	50·0	250·0	230·0	Randfontein (*a*)	D	110·1*	1178·4*	1212·1*
Anglo American					**General Mining**				
Daggafontein	D	142·6	1521·9	1544·0	Buffelsfontein	J	212·0	1059·0	972·0
P. Brand	S	46·0	90·8	97·0	Ellaton	D	17·0	197·0	181·0
P. Steyn	S	60·5	119·7	127·0	Stilfontein	D	90·0	947·0	1007·0
Vaal Reefs	D	146·1	1576·4	1362·0	W. Rand Cons. (*a*)	D	202·5	2220·1	2456·9
Welkom	S	57·5	113·8	125·0					
West. Reefs Ex.	D	160·8	1751·6	1689·0	**Anglo Transvaal**				
					Hartebeestfontein	J	258·0	1312·6	1308·0
Central Mining					Loraine	S	37·0	73·0	71·0
Blyvoor	J	155·0	767·4	763·7	N. Klerksdorp	D	11·0	120·5	131·5
Harmony	J	183·5	974·9	679·6	Virginia O.F.S.	J	180·8	887·8	924·8

Table includes profit from uranium, acid and pyrite before loan redemption. (*a*) Total profit from uranium section. (*b*) Overall profit. *Net revenue after provision for loan redemption.

International Mineral Processing Congress

IT was announced in our issue of September 18, 1959, that the Institute of Mining and Metallurgy will hold an international mineral processing congress at Church House, Westminster, London, S.W.1, on Wednesday, Thursday, Friday and Saturday, April 6-9, 1960. Further particulars of the proposed congress are now available and provisional papers for presentation are:

Group 1 — Comminution

" Fundamental Study of Grinding Characteristics of Tumbling Mills," by R. T. Hukki, professor of mineral dressing, State Institute for Technical Research, Helsinki, Finland ; " Theoretical Concepts of the Aerofall Mill with Illustrations of Plant Practice," by D. Weston, president, Aerofall Mills Ltd., Toronto, Canada ; " Grinding Tests on Magnetite Ores with Aerofall Mill and Wet and Dry Rod Mills," by Bengt Fagerberg and Herbert Orenstein, Luossavaara-Kiirunavaara Aktiebolag, Malmberget, Sweden; and " Open and Closed Circuit Grinding on a Laboratory Scale," by D. G. Armstrong, The General Electric Co. Ltd., Erith, England.

Group 2—Classification and Thickening

" Improvement of Classification Efficiency in Hydraulic Cyclones by Water Injection," by D. F. Kelsall (now with C.S.I.R.O., Melbourne, Australia) and J. A. Holmes, senior research metallurgist, Research and Development Division, Rhoanglo Mine Services Ltd., Kitwe, Northern Rhodesia ; " On the Mechanism of Thickening," by A. M. Gaudin, professor of mineral engineering, Massachusetts Institute of Technology, United States, and Maurice C. Fuerstenau, research assistant ; " Design and Performance of Cyclone Thickeners," by D. Bradley, Chemical Engineering Division, Atomic Energy Research Establishment, Harwell, England; " Increased Efficiency of Metallurgical Plants by Improved Continuous Filtration," by D. A. Dahlstrom, director, Research and Development Department, Eimco Corporation, Paladin, Illinois, United States ; and " A Process of Centrifugal Separation Using a Rotating Tube," by Gianfranco Ferrara, Instituto di Arte Mineraria e Preparazione dei Minerali, University of Cagliari (Sardinia), Italy.

Group 3—Flotation Research

" Study of Superficial Layers of Flotation Reagents on Minerals and the Influence of the Structure of Minerals on their Interaction with Reagents," by I. N. Plaksin, professor of mineral dressing, corr. member of the Academy of Sciences, U.S.S.R., head, Section of Mineral Dressing of the Institute of Mining, Academy of Sciences, Moscow, U.S.S.R.; " Effect of Contact Time, Temperature and Surface Condition on the Adhesion of Bubbles to Mineral Surfaces," by M. A. Eigeles, professor, Mineral Research Institute, Ministry of Geology and Protection of the Mineral Resources of the U.S.S.R., and M. L. Volova ; " Theoretical Basis of Flotation by Gas Precipitation," by V. I. Klassen, professor, head of Laboratory of Mineral Dressing, Institute of Mining, Academy of Sciences of the U.S.S.R.; " Physical Stability of Collector Adsorption Layers on Mineral Surfaces and Methods for their Destruction," by V. A. Glembotsky, professor, head of Laboratory of Flotation and Flotation Reagents, Institute of Mining, Academy of Sciences, U.S.S.R.; " Kinetics of Flotation Reagent Sorption," by O. S. Bogdanov, professor, vice-director, Institute Mechanobr, Leningrad, U.S.S.R., and A. K. Podnek, V. J. Hainman, N. S. Michailova ; " Wetting of Solid in Solutions of Surface-Active Substances as a Function of Solute Concentration," by Masayoshi Wada, professor of mineral dressing, Tohoku University, Japan ; " On the Misinterpretation of Contact Angle ; 1, Deformation of Air/Liquid Interface and Tenacity of Bubble Adhesion ; 2, Effect of Bubble Size and Threshold Hydrophobicity of Solids," by J. Leja, associate professor of metallurgy, and G. W. Poling, research engineer, Department of Mining and Metallurgy, University of Alberta, Canada ; " Some Factors Affecting Selectivity in the Differential Flotation of Lead-Zinc Ores Particularly in the Presence of Oxidized Lead Minerals," by Maurice Rey, professor, Ecole Nationale Superieure des Mines, director of flotation research, Societe Miniere et Metallurgique de Penarroya, Paris, and Victor Formanek, head of laboratory, Minerais et Metaux, France.

Group 4—Flotation Practice

" Flotation of Brown Iron Ores and Slimes from Gravity Treatment of Manganese Ores," by Z. S. Bogdanova, S. I. Gorlovsky and B. M. Lakota, Institute Mechanobr, Leningrad, U.S.S.R.; " Agglomeration Flotation of Ilmenite Ore at Otanmaki " by Urmas Runolinna, mill superintendent, Otanmaki Oy. Finland, Risto Rinne and Sakari Kurronen ; " Some Effect of Depressants in the Flotation of a Lead Ore," by K. S. Blaskett principal research officer, C.S.I.R.O., Ore Dressing Investigations, Melbourne, Australia; " Some Factors which Influence Ilmenite Flotation," by Olav Mellgren, lecturer at the Royal School of Mines, London, Odd Eidsmo, chief of ore testing at Titania A/S, Norway; and " Felspar-Mica Separation, an Unusual Flotation Flowsheet," by J. N. Wilson, Colin Stewart Ltd., England.

Group 5—Gravity and Dense Media Separation

" Developments in the Treatment of Malayan Tin Ores," by I. R. M. Chaston, research officer, Department of Mines Research Division, Ipoh, Federation of Malaya ; " Use and Recovery of

Tetrabromoethane (T.B.E.) in Mineral Dressing," by A. Baniel, chief chemist, and A. Mitzmager, Mineral Dressing Department, Israel Mining Industries, Haifa, Israel ; " Study of Efficiency of Dense Media Separators Used in Diamond Dressing," by A. C. Nesbitt and R. G. Weavind, director of research, Industrial Distributors (1946) Ltd., Diamond Research Laboratory, Johannesburg, South Africa ; " Some Studies Affecting Concentration on Oscillating Tables," by H. Kirchberg, professor, and W. Berger, Forschungsinstitut fur Aufbereitung, Freiberg, Saxony ; " Principles of Dense Media Separation in Hydrocyclones," by E. Cohen and R. J. Isherwood, Department of Mineral Dressing, Royal School of Mines, London ; " Magnetic Regulation of Underflow Discharge of a Dense Media Washing Cone," by P. Moiset, professor, Department of Mines, Faculte Polytechnique de Mons, Belgium, and R. Dartois, Ateliers de Construction de la Basse-Sambre, Belgium ; " Study of the Motion of Particles in a Jig Bed," by G. D. Lill, formerly of the Department of Mines, University of Leeds, now with United Steel Companies Ltd., Research and Development Department, and the late Mr. H. G. Smith.

Group 6—Magnetic and Electrical Separation ; Sorting

" Wet Magnetic Separation of Feebly Magnetic Minerals, and Results of Canadian Tests with Magnetic Separator," by G. H. Jones, head of Department of Mechanical and Electrical Engineering, Camborne School of Metalliferous Mining, Cornwall ; " The Forrer Separator ; a New Apparatus for Wet Separation of Weakly Paramagnetic Materials," by J. De Robert and L. Casnabet, Institut de Recherches de la Siderurgie, Station d'Essais (I.R.S.I.D.), Moselle, France ; " Effects of Surface Conditioning on Electrostatic Separation of Minerals of Low Conductivity," by I. A. Kakovsky, professor, Ural Polytechnic Institute and V. I. Revnivtzev, Institute Uralmechanobr, Sverdlovsk, U.S.S.R.; " New Developments in the Magnetic Concentration of Iron Ores," by F. D. Devaney, director of metallurgy and research, Picklands Mather and Co, Duluth, United States ; " Concentration of Magnetite Ores with Dry Magnetic Separators of Mortsell-Sala Type," by P. G. Kihlstedt, professor of mineral dressing, and B. Skold, Royal Institute of Technology, Sweden ; " Magnetizing Reduction in a Recuperative Rotary Furance," by Sven Eketorp, Research Department, Stora Kopparbergs Bergslags Aktiebolag, Sweden ; " An Optical Method of Separating Diamonds from Opaque Gravels," by A. A. Linari-Linholm, Diamond Research Laboratory, Crown Mines, Johannesburg, South Africa.

Group 7—Chemical Processing

" Development of the Autoclave-soda Process for the Treatment of Tungsten Concentrates," by N. N. Maslenitsky and P. P. Perlov, Institute Mechanobr, Leningrad, U.S.S.R.; " Technical Aspects of Uranium Ore Treatment in Australia," by the staff of Research and Development Branch, South Australian Department of Mines, Adelaide, Australia ; " Recent Development in the Chemical Treatment of Uranium Ore in France," by Robert Bodu, chief of Plants Group, Research and Mineral Exploitation Branch, Atomic Energy Commission, France ; " Pressure Leaching of Some Minerals in Alkali Solutions," by A. R. Burkin, department of mineral dressing, Royal School of Mines, London.

Group 8—Process Study

" Beneficiation of Low-Grade Manganese Ores, with Particular Reference to Semi-Pilot-Plant Studies on a Low-Temperature Magnetizing Reduction Process for Ferruginous Manganese Ores," by G. V. Subramanya and P. I. A. Nanayanan, National Metallurgical Laboratory, Jamshedpur, India ; " Application of Flotation in the Clean-up of Gravity Tin Concentrates," by F. B. Michell, vice-principal, Camborne School of Metalliferous Mining, Camborne, England ; " Development of a Process for the Concentration of Sukulu Apatite," by M. G. Fleming, reader in mineral dressing, Royal School of Mines ; and A. J. Robinson, metallurgist-in-charge, Sukulu Mines, Ltd., Tororo, Uganda, East Africa.

Group 9—Control and Testing

" Linear Assessment of Flotation Results," by W. H. Andrews, research metallurgist, The Zinc Corporation, Ltd., Broken Hill, Australia ; " Separation Factor Analysis for Mineral Dressing Processes," by Marcus Digre, mineral dressing laboratory, Institute of Technology, Trondheim, Norway; " Statistical Analysis of Some Variables in Flotation Testing, Leading to the Design of a Modified Flotation Cell," by P. Raffinot, Minerais et Metaux, Paris, France ; " Some Laboratory Techniques Developed for Ore Dressing Mineralogy," by L. D. Muller, mineralogist, Mineral Dressing Group, U.K.A.E.A., (now at D.S.I.R., Warren Spring Laboratory, Stevenage); " Automatic Control in Mineral Processing," by M. J. Cahalan, chief metallurgist, Rio Tinto Management Services (U.K.) Ltd., and R. Wolski, chief engineer, Systems Study Group, Elliott Brothers (London) Ltd.

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Book Reviews

Indium, *compiled by Maria Thompson Ludwick. Published by The Indium Corporation of America; Research and Development Office, 60 E. 42nd St., N.Y.C.; Sales Office and Laboratory, 1676 Lincoln Avenue, Utica, N.Y. Pp. 770.*

This second and completely revised edition of *Indium*, is the result of more than 30 years spent in the systematic collection of data. Abstracts of articles from all available sources have been prepared, patent information has been accumulated, and all known information is assembled in an annotated bibliography.

The history of the Indium Corporation of America is given in detail, since this company developed the element from a research laboratory curiosity to a metal of commercial importance and availability. The price of indium has dropped steadily as greater quantities have been made available. While indium is still considered an ounce metal, its cost in actual practice is not prohibitive, because a small quantity produces the desired results.

New applications are reported frequently and since the close of World War II, special interest has been shown in the value of this metal in such widely divergent uses as electronics, nuclear physics, corrosion-resistant plating, dental alloys, engine bearings and many others. The table of contents lists these various subjects, but no attempt has been made to cover them in their entirety, since the bibliography gives complete reference sources.

Alloys of indium are particularly promising. The addition of small quantities of indium has the general effect of hardening and strengthening the metal with which it is alloyed, and of increasing the tarnish or corrosion resistance.

Extensive study has been made on the various alloy systems with indium, which are reviewed by E.A.Peretti Sc.D., Head of the Department of Metallurgy, University of Notre Dame, Notre Dame, Indiana, in a comprehensive survey covering 36 pages together with a further 50 pages of phase diagrams

The field in which indium has received its greatest recognition is the bearing industry. Because of relatively high oil temperatures, generation of acid in the oil, heavy loads and the necessity of high wettability, indium is of prime importance to the silver-lead-indium bearing, which, it is stated, is today the accepted aviation bearing for engines. Data are also given on brazing alloys and on *Indalloy* intermediate solders, the latter being a new series of solders having melting points and working temperatures between those of soft solders and the commercial hard solders.

Other sections of the book are devoted respectively to nomographic charts of pellets and spheres to assist in the calculations required in their production, and to the chemical properties and compounds of indium.

The annotated bibliography of indium occupies 550 pages and covers the period 1863-1958 inclusive, being divided into a number of sections devoted to such aspects as general and physical chemistry, magnetic properties, electronic properties, optical spectra, nuclear phenomena electrochemistry, analytical chemistry, mineralogical and geological chemistry, metallurgy and metallography, alloys, and applications.

The aim has been to collect and collate sufficient information to enable the worker to pursue technical research easily and rewardingly. Every attempt has been made to cover completely the requirements of all those interested in the element and its sources, extraction, refinement, properties, and its present and possible future uses.

"Winding and Transport in Mines" *by Professor John Sinclair. 370 pp. 207 illustrations. Pitman's. London. 60s.*

This is the sixth of a series of ten textbooks currently being published by Sir Isaac Pitman and Son Ltd., having as their author Professor John Sinclair, Head of the Mining Department, University College, Cardiff. Previous titles in this series are :—Geological Aspects of Mining; Coal Mining Economics; Water in Mines and Mine Pumps; Coal Mining Law, and Environmental Conditions in Coal Mines. Yet to be issued are textbooks dealing with Winning Coal; Coal Preparation and Power Supply; Ground Movement and Control in Collieries, and Planning and Mechanized Drifting in Collieries. Truly the author has painted a large canvas but he has done it in stages. A series of monographs such as this has many advantages over the encyclopaedic textbook, not the least being that it enables the student to buy only what he requires.

As with the earlier books in this series, "Winding and Transport in Mines" is chiefly concerned with British Colliery Practice, and in fact certain of the conclusions drawn by the author might not stand up to close scrutiny in the light of overseas metalliferous experience. However, fundamental differences cannot occur and much of the text is concerned with fundamentals of mechanical engineering. There are some very good worked examples illustrating how transport and winding systems are correctly specified and each of the ten chapters concludes with selected questions of the type commonly confronting the advanced student of mining in the examination hall.

The book deals with ancillary haulage equipment in addition to discussing at length the various transport systems, and the chapter on brakes and automatic contrivances is particularly useful. Winding diagrams are considered in some detail and an account is given of modern trends and developments in the field of hoisting. Many authorities contend that mining is essentially a large scale exercise in bulk transport. If this is the case, Professor Sinclair's book is doubly useful, for not only are the mechanical aspects of this subject adequately covered but the author has also laid emphasis on actual installation and operational procedure.

If any criticism is warranted it is that the index is rather incomplete. Since this book is designed largely with the needs of students in mind, ease of reference is of considerable importance. Considered overall, however, "Winding and Transport in Mines" undoubtedly maintains the high standards set by Professor Sinclair's other publications.

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Overseas Geology and Mineral Resources, Vol. 7, Number 4. H.M. Stationery Office (Price 10s.). This issue contains articles entitled "The Geology of Gough Island, South Atlantic," by R. W. Le Maitre; "A Survey of Paleomagnetism," by D. W. Collinson and A. E. M. Nairn; and "A Palaeomagnetic Survey of the Karroo System: Progress Report for the Rhodesias, Bechuanaland, Swaziland and Kenya," by A. E. M. Nairn. Index for Volume 7 is also included.

Estimated World Crude Oil Production and Refining Capacity, 1958. Map. 40in. x 30in., published by Petroleum Information Bureau, price 2s. post free. This latest edition of the P.I.B. wall map indicates by symbols the relative importance of the world's oil producing and refining countries, together with statistics for 1958.

Prospectus 1960-61, for Imperial College of Science and Technology (University of London), is now available.